SECTION 3
CONFIGURATION IDENTIFICATION

QUESTIONS THIS SECTION WILL ANSWER	Para.
1. What is the configuration identification process and why is it necessary?	3.1
2. What are the performance attributes of the configuration identification process?	3.1.1, 3.1.2
3. What inputs provide the information needed to make intelligent configuration identification decisions?	3.1
4. What is a Product Structure; how is it determined and used?	3.2
5. What are configuration items? Does the Government establish a baseline for all configuration items?	3.3, 3.3.1, 3.3.2
6. What documents should the Government be concerned about? Which should be left to contractor discretion?	3.4
7. How does the Government select the appropriate document type to specify performance? How does the contractor?	3.4.1, 3.4.2
8. How shall Performance Specifications be used? What are the difference types of performance specifications.?	3.4.2
9. What is a Detail Specification and when may it be used?	3.4.2
10. What visibility into the contractor's design solution does the Government need?	3.4.3, 3.4.4
11. How do we determine what baselines should be established?	3.5
12. How many levels of baselining are necessary? How do they evolve over the life cycle?	3.5.1, 3.5.2
13. How should documents be identified?	3.6, 3.6.1, 3.6.2
14. How should items be physically identified? To what level does the Government need discrete identifiers?	3.6.3, 3.6.4
15. What is the engineering release process? Why is it important?	3.7, 3.7.1
16. How does the Government determine the appropriate level of detailed design data to acquire?	3.72
17. What data content and functional capability should be expected from an engineering release process?	3.7.2
18. How are external and internal interfaces defined?	3.8
19. What is the relationship of interface control documents/drawings to configuration documentation.?	3.8.1, 3.8.2
20. How involved should the Government be in the management of interfaces?	3.8.1, 3.8.2

3.1 Configuration Identification Activity

Configuration identification incrementally establishes and maintains the definitive current basis for control and status accounting of a system and its configuration items (CIs) throughout their life cycle. (development, production, deployment and operational support, until de-militarization and disposal). The configuration identification process ensures that all acquisition program management disciplines have common reference points for item nomenclature, and configuration documentation numbering and release practices. Good configuration control procedures**[Section 4]** ensure the continuous integrity of the configuration identification. The configuration identification process includes:

- Selecting configuration items at appropriate levels of the product structure
- Determining the types of configuration documentation required for each CI to define its performance, functional and physical attributes, including internal and external interfaces. Configuration documentation provides the basis to develop and procure software/parts/material, fabricate and assemble parts, inspect and test items, and maintain systems
- Determining the appropriate configuration control authority for each configuration document consistent with logistic support planning for the associated CI
- Issuing identifiers for the CIs and the configuration documentation; maintaining the configuration identification of CIs to facilitate effective logistics support of items in service

- Releasing configuration documentation; and establishing configuration baselines for the configuration control of CIs.

Effective configuration identification is a pre-requisite for the other configuration management activities (configuration control, status accounting, audit), which all work with the products of configuration identification. If CIs and their associated configuration documentation are not properly identified, it is impossible to control the changes to the items' configuration, to establish meaningful records and reports, or to validate the configuration through audit. Inaccurate or incomplete configuration documentation may result in the creation of defective products, schedule delays, and higher maintenance costs after delivery.

Figure 3-1 is an activity model of the configuration identification process. It is a more detailed view of a portion of the configuration management activity model described in Section 2 **[Reference: Figure 2-1]** It highlights the relationships between the elements of configuration management that will be discussed in the following paragraphs. As in the previous activity model, the boxes represent activities; the lines entering at the left of each box are inputs; those entering from the top are constraints; those entering at the bottom are facilitators or mechanisms; and the lines leaving each box from the right are outputs.

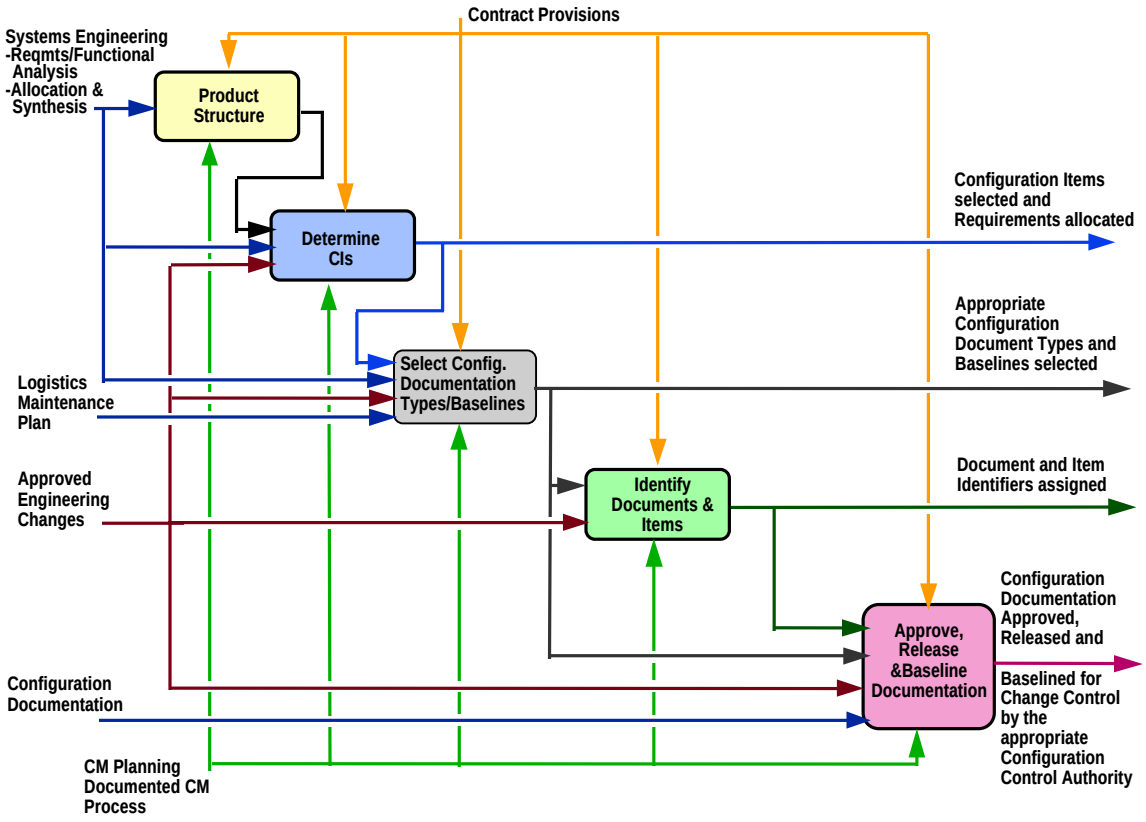

Figure 3-1. Configuration Identification Process Activity Model

3.1.1 Configuration Identification General Concepts and Principles

The basic principles of configuration identification are articulated in EIA Standard 649, the “National Consensus Standard for Configuration Management.” It cites the following purposes and benefits of configuration identification:

- Determines the structure (hierarchy) of a product and the organization and relationships of its configuration documentation and other product information
- Documents the performance, interface and other attributes of a product
- Determines the appropriate level of identification marking of product and documentation

- Provides unique identity to a product or to a component part of a product
- Provides unique identity to the technical documents describing a product
- Modifies identification of product and documents to reflect incorporation of major changes
- Maintains release control of documents for baseline management
- Enables a user or a service person to distinguish between product versions
- Enables a user or a service person to correlate a product to related user or maintenance instructions
- Facilitates management of information including that in digital format (See 5.6.)
- Correlates individual product units to warranties and service life obligations
- Enables correlation of document revision level to product version/configuration
- Provides a reference point for defining changes and corrective actions.

The basic principles guide effective practices by both Government and industry. They are independent of specific methods of acquisition practice. A particular method of acquisition practice such as "Performance based acquisition" influences the types of Government controlled documents that are selected to define systems or configuration items and the distribution of responsibilities for approving changes to specifications and detailed design documentation. It also offers contractors flexibility in choosing the methods of design definition. However, it does not alter the necessity for both Government (the acquiring activity) and Contractors (the performing activity) to implement practices that employ the basic CM principles.

The single process initiative enables a contractor to employ a common set of practices to all products and services they provide to the Government from a given facility. The Government's contractual requirements must respect the contractors common process in order to realize significant acquisition cost savings. To transition from individual contract-based processes to a common set of practices, a "block change methodology" may be employed.

The Government's standard identification practices should be applied only at the level at which items are designated as configuration items **[Detail 3.2.1 and 3.3]** and at which Government approved performance specifications are written. Contractor practices, meeting the principles of EIA-649, should be applied to commercial items used in Government systems, to CIs whose performance requirements are allocated and approved only by the contractor, or to items below the CI level that are within the contractors design cognizance.

3.1.2 Configuration Identification General Activity Guides

Acquisition reform and the single process initiative will not result in overall life cycle savings to the Government if contractor configuration identification practices result in products that cannot be adequately operated and maintained during the operational support period. Identification practices that do not conform to the basic CM principles cannot be relied on to assure that end items will have the functionality and performance indicated by their CI identifiers.

It is therefore essential that contractor process adherence to the basic principles be evaluated as part of the source selection process. A configuration identification process evaluation checklist, **Table 3-1**, is provided to assist in this process. Since individual contract surveillance is counter to common process implementation, such means as capability assessments, past performance and DCMC inter-action are the preferred methods for this evaluation. Appropriate metrics and periodic assessments of contractor performance in conforming to documented and approved processes are also necessary. However, where a common process is employed, the Government should avoid redundant reviews on a contract by contract basis.

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Activity Guide: Table 3-1. Configuration Identification Process Evaluation Checklist

✓	Items to Review
	1. Documented Process
	a. Does the contractor have a documented Configuration Identification process?
	b. Does the contractor follow the documented process?
	c. Are contractor personnel from all disciplines and teams involved in the process informed and knowledgeable about the procedures they are supposed to follow?
	2. Product Structure
	a. Is the product (System/CIs) structured into a rational hierarchy?
	b. Are subordinate CIs identified at a reasonable level for: (1) Specification of and measurement of performance? (2) Management of the effectivity of changes?
	c. Can the composition of each System/CI be determined from the configuration documentation
	3. Configuration Documentation
	a. Does the contractor's configuration documentation define the performance, functional and physical attributes of each System/CI ?
	b. Do the performance requirements of the system and/or top level Configuration Item specifications meet or exceed threshold performance of the Acquisition program baseline?
	c. Are all configuration documents uniquely identified? (1) Does the identification reflect the source (CAGE code) of the preparing original design and current design activity, the type of document, and an alphanumeric identifier? (2) Can each document be easily associated with the CI configuration to which it relates and where applicable, the range of CI serial numbers to which it applies?
	4. Product Identification
	a. Are all Systems/CIs/CSCIs and subordinate parts down to the level of non-repairability assigned individual unique part/item identifiers ?
	b. Do the assigned identifiers enable (1) Each part/item to be distinguished from all other parts/items? (2) Each configuration of an item to be distinguished from earlier and later configurations?
	a. Can the next higher assembly application of each part be determined from the design documentation (including associated lists/records)?
	b. Does the documentation indicate whether CIs are serialized (or lot controlled)?
	c. Is the common base identifier for serialization/lot numbering always an non-changing identifier?
	d. Is part/item effectivity to be defined in an a manner appropriate for the product type?
	e. When an item is changed to a new configuration, is its identifier altered in both the configuration documentation and on the item itself to reflect the new configuration?
	f. When an existing item is modified, does it retain its original serial number or lot number even though its part/item identifier is changed?
	g. Are CSCI versions identified and, if applicable, associated to the configuration of the item into which they are to be installed/loaded?
	5. Configuration Baselines
	a. Are appropriate configuration baselines established and maintained as a basis for configuration control?
	b. Are functional and/or allocated baselines established and maintained for Systems and CIs to be controlled by the Government?
	c. Are functional and/or allocated baselines established and maintained for Systems and CIs to be controlled by the contractor? By subcontractors?
	d. Is the current configuration baseline easily determinable?
	e. Is an adequate system of release control in place and used for the release of all configuration documents?
	(1) Can the as-released configuration of each CI be determined?
	(2) Can past configurations be determined?
	(3) Do release records reflect the authority for changing from one configuration to the next? Do they

Activity Guide: Table 3-1. Configuration Identification Process Evaluation Checklist

✓	Items to Review
	reference the ECP identifier and Contract Modification (where applicable)?
	(4) Does the release system prevent unauthorized changes to released documents?
	6. Interface Control
	a. For interfaces external to the contractor, are interface agreements established where necessary to document and agree to performance, functional and physical interfaces?
	b. Do CIs being developed by different contractors for the program have well defined interfaces?
	7. Metrics
	a. Are statistical records of document release and other measurable configuration identification actions maintained?
	b. Is the data reduced to meaningful measurement useful in maintaining and improving the process?

3.2 Product Structure

Product Structure, also referred to as system architecture, refers to the identification, internal structure, and relationship of system components and associated configuration documentation. Product structure, derived from the functional analysis and allocation process of system engineering, may be depicted graphically as a tree structure or as an indented listing.

3.2.1 Product Structure Concepts

As a program matures through its early phases, the systems engineering process produces the optimized functional and physical composition of the system architecture to the level that it is necessary for the Government to specify and control item performance. This is the lowest level at which CIs are designated during the Engineering and Manufacturing Development Phase of the life cycle. Management tools such as specification and drawing trees, and work breakdown structures are all views of the product structure which are directly relatable at the CI level.

Program and contract work breakdown structures (WBS) are task oriented family tree views of the product structure showing the hardware, software, services, data, and facilities against which costs are collected. The WBS relates the elements of work to be accomplished to each other and to the end product. CIs are identified as work breakdown structure elements. Uniform element terminology, definition, and placement in the upper three levels of a WBS are common for many categories of defense materiel **[Ref: MIL-STD-881]**. The WBS is extended to lower levels by the DoD component and contractor(s).

Product structure activity guidance is included in Table 3-1.

3.3 Configuration Items

Systems and selected items of hardware or software (or a combination thereof) comprising the system in which the Government or acquiring activity has configuration management concern, are designated as Configuration Items (CIs).

3.3.1 Configuration Item Concepts

CIs are the basic units of configuration management. They may vary widely in complexity, size and type, from an aircraft, ship, tank, electronic system or software program to a test meter or a round of ammunition. Regardless of form, size or complexity, the configuration of a CI is identified and controlled. CI selection separates system components into identifiable subsets for the purpose of managing further development. For each CI:

- There will be associated configuration documentation (which may range from a performance specification to a detailed drawing to a commercial item description) **[See 3.4.2]**
- Configuration changes will be controlled
- Configuration status accounting records will be maintained
- Configuration audits will be conducted to verify performance and product configuration (unless the CI has an already established product baseline).

To define and control the performance of a system or CI, does not mean that all of its hardware and software components must be designated as CIs. The requirements to be met by a lower-level component (which is not designated as a CI) are established and controlled via the Contractor's design and engineering release process. Government control occurs only when changes to the lower level components impact the specified requirements for the CI.

Initial CI selection should reflect an optimum management level during early acquisition. Initially, for Engineering and Manufacturing Development (Phase II), CIs usually are the deliverable, and separately installable units of the system and other items requiring, significant management attention at Buyer/Seller interfaces (i.e. Government/Prime Contractor, Prime Contractor/Subcontractor, etc). During, Production, Fielding/Deployment and Operational Support (Phase III), individual items required for logistics support and designated for separate procurement are also CIs. As shown in **Figure 3-2** the view of what is considered a CI may depend on where in the contracting tree the view originates.

Computer software, because it typically controls the functionality of a system is almost always designated as CIs. The term CI encompasses both hardware and software; when a statement in this handbook applies only to hardware, or only to software, the terms HWCI and CSCI are used.

Typically the top tier of CIs directly relate to the line items of a contract and the work breakdown structure. Their selection is normally simple and straight forward. However, there are many cases in which other items should be selected based on management judgment. Some of the primary reasons for designating separate CIs are:

- Critical, new or modified design
- Independent end use functions
- Sub-assembly factors such as the need for separate configuration control or a separate address for the effectivity of changes **[Details: Section 4]**
- Components common to several systems
- Interface with other systems, equipment or software
- Level at which interchangeability must be maintained
- Separate delivery or installation requirement
- Separate definition of performance and test requirements.
- High risk and critical components

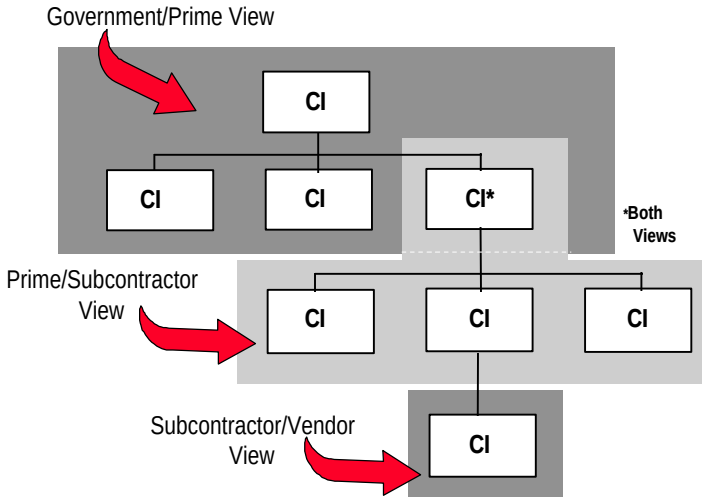

Figure 3-2. Tiering of CI Designations

Although the initial CI selection generally occurs early in the acquisition process, its consequences are lasting and affect many aspects of program management, systems engineering, acquisition logistics, and configuration management. CI selection establishes the level of Government configuration control throughout the system life cycle. Selecting CIs separates a system into individually identified components for the purpose of managing their development and support. Government CI designation should reflect the optimum level for both acquisition and support. During acquisition, this is the level at which a contracting activity specifies, contracts for, and accepts individual components of a system. During support, this is the level at which the logistics activities organize, assign responsibility and report modification and maintenance actions.

During the concept exploration and the program definition and risk reduction phases, the system architecture is established, the program work breakdown structure is developed, and major CIs are defined. These decisions provide the basis for the Supportability Plan for the program, which, in turn, dictates the selection of lower level CIs. Development, acquisition, retrofit, and hardware and software interfaces are all based on the selection of CIs during initial development.

[Details 3.3.2; *Activity Guide:* Table 3-2. Configuration Item Selection Criteria]

3.3.2 Configuration Item Activity Guides

Many engineering requirements or considerations can influence the selection of CIs. Throughout development and support, the allocation of engineering effort and organization are rooted in the selection of CIs. Developing contractors should participate in the selection process and provide recommendations based upon engineering or other technical considerations.

Selection of CIs is an iterative integrated process involving acquisition program management, systems engineering, and acquisition logistics working with configuration management. CI selection criteria are applied to contractor recommendations for items to be managed as CIs at the Government/Contractor interface. In addition, the contractor determines which items in the system will be designated as CI for lower tier configuration management.

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Activity Guide: Table 3-2. Configuration Item Selection Criteria

The process of selecting configuration items requires the exercise of good systems engineering judgment based on experience, supported by cost trade-off considerations. No fixed rules govern CI selection or dictate the optimum number of CIs for a particular system. Rather guidelines for making the appropriate judgments are provided in the "General Guidance", "CI Selection Checklist." and "Additional Factors".
General Guidance:
1. Designating a system component as a CI increases visibility and management control throughout the development and support phases. For system critical or high technical risk components, added visibility can help ensure that requirements are met as specified and schedules maintained.
2. For each development contract, there should be at least one CI designated.
3. For complex systems major functional design components are usually designated as CIs. The initial selection is normally limited to the major component level of the work breakdown structure.
4. As system design evolves during development and complex items are further subdivided into their components, additional CIs may be identified.
5. Developing contractors should be given maximum latitude to design below the system level. Changing system architecture or the reallocation of functions after a baseline has been established by the Government should be avoided.
6. The selection of CIs should reflect a high degree of independence among the CIs. Each CI should represent a logical entity which implements at least one end use function. The subordinate elements of each CI, which are defined during the detail design process, should all be functionally related.
7. Operational software should always be separated from support software.
8. The number and complexity of CI interfaces in a system should be minimized. (As a general rule, the more interfaces created by top-level design, the more complex the system becomes. Complexity often results in increased risk and cost.
9. All subassemblies of a CI should have common mission, installation and deployment requirements.
10. Where several systems include common components, subsystems, or support equipment, CI designation should reflect the common items
11. A unique component which is peculiar to only one of multiple similar systems should be identified as a separate CI of that system.
12. Off-the-shelf privately developed items generally should not be designated as CIs. However, commercially available items that have been modified at Government expense should not necessarily be excluded from CI selection. (Factors to consider include the extent of the modification, the criticality of the modified CI to the mission of the system, and the extent of ownership, data rights, and configuration documentation required and available to the Government).
13. Generally, any NDI designated for logistic support by Government personnel should be designated as a CI. In such cases, the Government must acquire sufficient configuration documentation to enable the support..
CI Selection Checklist
If most of the answers to the following questions are "yes", the item should be considered for designation as a separate CI. If most answers are "no", it probably should not be designated as a CI. However a single over-riding 'yes" may be sufficient to require an item to be separately identified as a CI.
1. Is the item's schedule critical or high risk? Would failure of the item have significant financial impact?
2. Does the item implement critical capabilities (e.g., security protection, collision avoidance, human safety, nuclear safety)? Would CI designation enhance the required level of control and verification of these capabilities?.
3. Will the item require development of a new design or a significant modification to an existing design?
4. Is the item computer hardware or software?
5. Does the item incorporate un-proven technologies?
6. Does the item have an interface with a CI developed under another contract?
7. Can the item be readily marked to identify it as a separate, controlled item?
8. Does the item interface with a CI controlled by another design activity?
9. Will it be necessary to have an accurate record of the item's exact configuration and the status of changes to it during its life cycle?
10. Can (or must) the item be independently tested?
11. Is the item required for logistic support?
12. Is it, or does it have the potential to be designated for separate procurement?
13. Have different activities have been identified to logistically support various parts of the system?
14. Is the item at an appropriate level for Government configuration control?

Activity Guide: Table 3-2. Configuration Item Selection Criteria

15. Does the item have separate mission, training, test, maintenance and support functions, or require separately designated versions for such purposes?
16. Do all subassemblies of the item have common mission, installation and deployment requirements, common testing and Government acceptance?
Additional Factors
1. Many development and support planning milestones are related to CIs. Critical milestones for such activities as performance or design verification demonstration, system integration and testing, technical reviews and audits, and budget allocation are based upon the selection of CIs, and are affected by .the number of CIs selected.
2. Existing CIs (available from the Government inventory) may be modified and designated as a separate and different configuration of that CI, thus saving time and money. Factors to be traded off include complexity, the use of new materials, processes, and the insertion of new technology.
3. There are no rules to dictate the optimum number of CIs for a given system. In general, however, the fewer CIs, the better. Selecting too many CIs increases development and support costs.
4. Each CI to be developed, especially CSCIs, comes with an associated set of technical reviews, audits, performance or design verification demonstrations, formal unit and integration tests, and documentation requirements. Each of these has an inherent development and maintenance cost.
5. The consequences of designating too many CIs include: • Numerous inter-CI interfaces to be defined, documented, and baselined; inhibiting the contractor's freedom to evolve his design solution, solve problems expeditiously, and implement advantageous change without contractual consequences. • CI functionality defined at too low a level or including unnecessary design constraints requiring formal test, and technical reviews, beyond what is required for the Government to achieve reasonable assurance of system performance. • Increased documentation disproportionate to the technical content of the documents • Excessive fragmentation which may actually decrease Government visibility and understanding of system performance. Fragmented description of functionality increases volume, is more difficult to understand, and complicates the document review, approval, and control process. • Increased Cost
6. The consequences of having too few CIs include: • Increased complexity of each CI resulting in decreasing management insight and ability to assess progress, while increasing maintenance time and costs of ownership. • Where the lowest level designated CI is a complex item (implementing unrelated functions, containing both hardware and software components, etc.): • The potential for reuse of the CI, or portions of the CI is diminished • Re-procurement of the CI and components is complicated • Potential re-procurement sources are limited.. • Formal testing of critical capabilities may be delayed or made more difficult. • The inability to account for the deployment of a CI, whose component parts are disbursed to different locations • Difficulty in addressing the effectivity of changes and retrofit actions, particularly when there are different quantities or separately deliverable components • Increased complexity in managing and accounting for common assemblies and components

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3.4 Configuration Documentation

The term configuration documentation is used to distinguish that information which defines the performance, functional and physical attributes of a product. As described in EIA Standard 649, all other documentation concerning a product such as its operation and maintenance manuals, illustrated parts breakdowns, test plans and procedures, etc. are all based on and related to the information in the configuration documentation. The configuration documentation associated with each CI provides the basis for logistics support, post-deployment software support, and re-procurement.

Acquisition reform has made a significant change in the types of configuration documents used to specify configuration items and on the baselining and configuration control of configuration documentation. Since the Government now specifies performance and, in most cases, leaves design solutions to the contractor, the Government determines the system product structure level at which to specify, baseline and control item performance and the specification type to be used. Below this level the contractor chooses the types of documentation to use.

3.4.1 Specification Concepts

The selection of the appropriate specification document types is dependent upon a number of factors such as the maturity of the item, and the context and environment in which it must operate. The new order of precedence defined by DoD policy strongly indicates preference for the use of existing commercial products, wherever possible, and the choice of products meeting Performance rather than Detail Specifications. **[Details: 3.4.2, *Activity Guide:* Table 3-3.]**

Program Unique Specifications, of both a performance and detailed nature are at the bottom of the selection list and are used when the other choices are not available or applicable. Nonetheless, acquisition programs dealing with the development of new systems will continue to see the use of program unique specifications where they are for a single system or item and have little potential for future use except for repetitive fiscal year production and spares purchases. Both the Government and contractors should seize opportunities at lower levels of the specification tree (where developed items, referred to as non-developmental items (NDI) may be used) to select higher precedence specification types, and to specify performance rather than design requirements, whenever possible. To aid in understanding the array of various designations used to identify specifications, **Figure 3-3,** illustrates how the specification document types may be categorized, where:

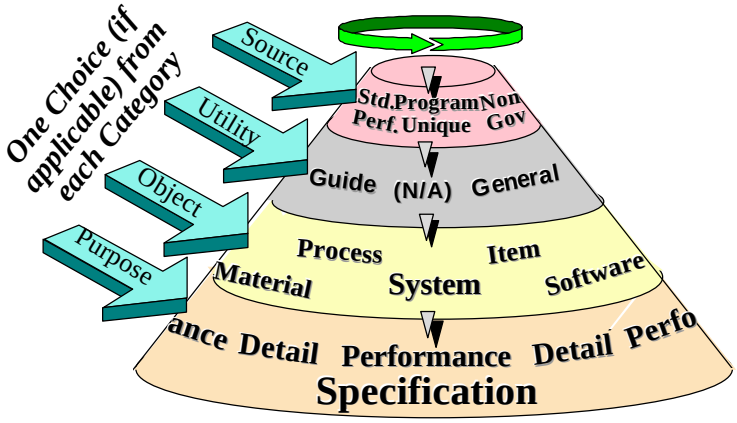

Figure 3-3. Selection of Specification Types

- **Source** (Non-Government, Commercial, Federal, Military, Program Unique) - category indicates the standardization/specification domain of the document. **[Detail: *Activity Guide*: Table 3-4]**
- **Utility** (General, Generic or Guide) if applicable- relates to the characteristic of the documents which facilitate standardization by providing "boilerplate" or templates for classes of items with largely common requirements. This category applies only to those documents where these characteristics are applicable. **[Detail: *Activity Guide*: Table 3-5]**
- **Object** (System, Item, Software, Material, Process) - represents the type of CI object in MIL-STD-961D, Appendix A that a specification is intended to define. The objects are not restricted to use with program unique specifications; they are applicable for use with the other source categories as well. They replace the MIL-STD-490 categories, e.g., prime item, critical item, inventory item, etc. **[Detail: *Activity Guide*: Table 3-6]**
- **Purpose** (Performance or Detail) - distinguish between performance and detail specifications. Their content and format of are delineated in MIL-STD-961D. Performance specifications define requirements and constraints for a system or CIs entering the engineering and manufacturing development phase or being acquired at a performance level. Detail specifications define requirements and a specific design for CIs entering a production, deployment and operational support phase. **[Detail: *Activity Guide*: Table 3-7]**

3.4.2 Specification Activity Guides

The activity guides for Specifications, **tables 3-3 through 3-7** follow.

Activity Guide: Table 3-3. Order of Precedence for Specifications

Order	Type of Document	Defined By	Use
I	**Specific Defined Documents**		
	• Various	Law, or regulation pursuant to law	When mandated
II	**Performance Documents (Not Program Unique)**		
	• Non-Government Standards	Industry Associations and Societies (e.g., ASME, ASTM, SAE, EIA)	When they contain only performance-based requirements sufficient for the intended acquisition
	• Commercial Item Descriptions		Commercially available item, performance description of which has been standardized
	• Federal Specifications		When an applicable Federal Specification (applicable for use by all agencies and departments) is available
	• Standard (General) Performance Specification (MIL-PRF-XXXXX)	MIL-STD-961D	**(See Note 1)**
III	**Detail Documents**		
	• Non-Government Standard	Industry Associations and Societies	**(See Notes 2 and 3)**
	• Federal Specification		**(See Notes 2 and 3)**
	Standard (General) Detail Specification (MIL-DTL-XXXXX)	MIL-STD-961D	**(See Notes 1, 2, and 3)**
IV	**Government Non-MIL, Non-Fed Standard/Specification**		
	• Purchase Description • Product Description • Specification	Multiple sources, various Government agencies	When a suitable, existing, document can be found

Activity Guide: Table 3-3. Order of Precedence for Specifications

Order	Type of Document	Defined By	Use
V	**Program Unique Specifications: Performance (PRF)/Detail (DTL)**		**(Notes 2, 3, 4 and 5 apply to all items below.)**
	• System Specification	MIL-STD-961D, Appendix A	When performance of system is specified. (Normally not a DTL unless extensive interface design must be specified.)
	• Item Specification	MIL-STD-961D, Appendix A	When an item is being acquired by the Government; to document the performance or detail requirements of a CI. (Government or Contractor) **(See Note 6.)**
	• Software Specification **[Also see Table 3- 9 Activity Guide, Software documentation]**	MIL-STD-961D, Appendix A and EIA/IS-640/ IEEE P1498, ISO/IEC 12207	Performance: When software development requirements Detail: When software design, interface and data base descriptions are included either in Appendices or by reference. **(See Note 6.)**
	• Material Specification	MIL-STD-961D, Appendix A	When a specific material for which there is no existing standard must be specified as part of the design solution by a contractor. **(See Note 7.)**
	• Process Specification	MIL-STD-961D, Appendix A	When a unique manufacturing, test method, or inspection process must be specified as part of the contractor's design solution. **(See Note 7.)**
VI	**(Legacy) MIL, FED or Program Unique Specifications**		
	• Various types	MIL-STD-490, etc.	Only for re-procurement of items not requiring major modification or upgrade or when a non-DoD customer or lead agency from another country requires it.

NOTES:

1. When the requirements can be cited using a General Specification, specification sheet, or MS sheet.
2. A Detail Specification is used when requirements for interface definition, safety, adequacy or interchangeability make specification of materials, design or construction requirements, or "how-to" information necessary.
3. Use of a Federal or Military Detail Specification by the Government requires a waiver granted by the applicable authority for the program's acquisition category (See DoDD 5000.2 and DoD Policy Memo 95-1) unless one or more of the following apply:
   - It is for re-procurement of an item not requiring major modification or upgrade
   - The contractor proposes its use in response to a solicitation
   - The acquisition is for Federal Supply Group 11 (Nuclear Ordnance) or Federal Supply Class 4470 (Nuclear Reactors)
   - It is required by a non-DoD customer or lead agency from another country in a joint acquisition
   - It is cited for guidance only
4. A Performance Specification is changed into a Detail Specification by addition of design requirements (design constraints, design solution) beyond the minimum required for interface and interchangeability.
5. A Program Unique Specification is used:
   - When there are no alternative higher precedence documents available
   - For a specific program or part of a single system (including repetitive fiscal year production and spares purchases), and
   - For which there is judged to be little potential for future use by subsequently developed systems.
6. Program Unique Item and Software Specifications are to be prepared as unified specifications containing all applicable performance and design requirements in a single document as opposed to separate development (or requirements) and product specifications, as in the past.
7. DoD discourages use of military unique material and process; commercial materials and methods shall be used wherever

Activity Guide: Table 3-3. Order of Precedence for Specifications

Order	Type of Document	Defined By	Use
	possible. (Ref: Policy Memo 95-6.)		

Activity Guide: Table 3-4. Specification Types Categorized by Source

This table describes various standardization/specification domains in which a specification may originate. This category is part of a string comprising the specification type. ***[See Fig. 3-3]***

Source	Description
Non-Government	Standards or specifications published by industry associations or societies recognized as standards making bodies by the American National Standards Institute (ANSI), which define minimum acceptable performance and quality, or precise interface requirements for a category of product. Examples of non-Government associations are ASME, SAE, EIA; example of performance/quality standard is SAE 30 motor Oil; examples of standard interfaces are electronic connectors, screw thread sizes.)
Commercial	Commercial Item Descriptions (CID), which are standard purchase descriptions which, by definition, are performance-based because they facilitate competitive bid for products meeting a stated functional requirement. Also commercial product descriptions (such as a manufacturer's catalog or specification sheet) and commercial purchase descriptions (item descriptions to be spelled out directly in a purchase order) qualify under this category.
Federal	Standards or specifications applicable to all agencies of the federal Government for items widely used. (They may be either performance or detail based)
Military	Specifications prepared for standard items with use in many different applications in weapons systems and their support equipment. These specifications are intended mainly for the competitive procurements of identical items for use as spares and for use in new weapons systems. Military Specifications are prepared in accordance with MIL-STD-961 and are listed in the DoD Index of Specifications and Standards (DODISS). They are subject to the requirements of the Defense Standardization Program.
Standard Performance	Standard Performance Specifications (MIL-PRF) are performance specifications for items common to a number of different systems and subsystems. They follow the same guide lines as other performance specifications (see category b. below). They differ from Military specifications in that they may be satisfied by different, perhaps competing products that are not identical but meet the same form fit and function requirements.
Program Unique	Specifications for a system, item, software, process or material, unique to a specific acquisition program, prepared by either Government or Contractor to define and baseline requirements for development, production (including repetitive fiscal year production and spares purchases), support and re-procurement. Program unique specification format and content, previously defined in MIL-STD-490 which is canceled, is defined in MIL-STD-961D, Appendix A, with considerably more flexibility.

Activity Guide: Table 3-5. Specification Types Categorized by Utility

This table describes a category of specifications which facilitate standardization by providing "boilerplate" or templates for classes of items with largely common requirements. This category applies only to those documents where these characteristics are applicable. This category is part of a set of categories which comprise the specification type. ***[See Fig. 3-3]***

Utility	Description
General, Associated, and Specification Sheets	A general specification is one which facilitates the preparation of specifications for a number of items that are common except for specific variables such as size, power, range, etc. The General Specification defines the common requirements; the specific variables of each item are defined in either associated specifications or specification sheets. Associated specifications are used when the variables require a number of pages of specification language to define. Specification sheets are used when the variables can be numerically tabulated. Both are linked by specification number to the related general specification. Typically the associated specification, or specification sheet is identified by the general specification number followed by a slash and a serially assigned identifier. (Example: "MIL-PRF-18/25) Where there is ambiguity (conflict) between the General Specification and the Associated Specifications or Specification Sheets, the latter governs because it describes the specifics of a product while the general specification encompass a family of products.
Generic or Guide	A Generic or Guide Specification is a tool for preparing a number of similar specifications for a class of like end items to be developed. The guide specification is a "template" which identifies all of the essential performance parameters normally associated with the class of item, but does not provide the specific performance capabilities. The specification is then tailored to fill in the blanks to create a specific system or item specification. Some specific, but design-independent, performance capabilities may be provided by the Government, prior to an RFP. The remaining performance capabilities would then be provided by each offerer. Typically inputs to the system and item specification are generated from the activities of prior program phases. Contractors also create generic specifications to use as "boilerplate" for preparation of a number of different item specifications with common requirements deriving from a common operating environment.

Activity Guide: Table 3-6. Specification Types Categorized by Object

This table describes the type of CI "objects" that a specification is intended to define. This category is part of a string of categories which comprise the specification type. ***[See Fig. 3-3]***

Object	Description
System	A system specification defines the overall performance and mission requirements for a system, allocates requirements to lower level components of the system, and identifies system interface and inter-operability constraints. It is the top-level functional requirements specification for the system. A system specification is used to establish a functional baseline for the system. Moderately large systems are usually decomposed; level two system components are often complex enough to be called "systems" themselves (although, for configuration management purposes, they are designated as CSCIs)
Item	The Item specification for a CI defines the performance and interface requirements and design and inter-operability constraints that have been allocated to the CI from a system or higher level CI. Item specifications provide the contractual basis for the development and verification of CI performance. The item performance (development) specification(s) will normally be used to establish the allocated baseline for the CI. An item performance (product) specification (essentially the same document) or an item detailed specification (containing specific design requirements) is used to provide the contractual basis for acquisition of production quantities of the CI. (See d.)
Software	Computer Software Configuration Items (CSCIs) are documented with software specifications prepared in accordance with MIL-STD-961D. A Software Performance Specification is similar to the Software Requirements Specification (formerly required by MIL-STD-2167A, and MIL-STD-498). A Software Detailed Specification is similar to the Software Requirements Specification plus the set of design documents describing the software, interface and database design. **[See Table 3-9]**
Material	Material specifications are used where a raw material, mixture, or semi-fabricated material has been developed specifically for use with a particular item or system and is critical to the performance or design of the item. (Example a missile rocket motor solid propellant chemical mixture.) The material specification is called out in the CI(s) design documentation. It therefore becomes part of the product baseline of the CI(s)
Process	Process specifications are used where a process (or service) has been developed specifically for use with a particular system/item and is critical to its performance or design. (A common Example - the curing process for the missile rocket motor solid propellant). The process specification forms a part of the product baseline of the CI(s)

Activity Guide: Table 3-7. Specification Types Categorized by Purpose

This table describes the categories which indicate the intent of the specification, i.e., distinguish between performance and detail specifications. This category is part of a set of categories which comprise the specification type. ***[See Fig. 3-3]***

Purpose Category	Description
Performance	A performance specification provides requirements for a system, item, software, process or material in terms of the required results and the criteria for verifying compliance. It defines the functional requirements, the operational environment, and interface and interchangeability requirements but does not state how the requirements are to be achieved; require the use of specific materials or parts; or give design or construction requirements beyond those design constraints necessary to unambiguously define interface and interchangeability requirements. The intent of a performance specification is to allow more than one design solution for the requirements specified so that interchangeable competitive products may be evaluated, and new technology may be inserted.
Detail	A detail specification may consist of all detail requirements or a blend of performance and detail requirements (MIL-STD-961D). However, the DoD preference is for one specification to convey all the performance and detail requirements for an item so that, for repetitive re-procurement, the function and performance attributes of the product are included. In fact, in appendix A of MIL-STD-961D (which addresses program unique specifications), clearly states that unified, rather than separate development/requirements and product specifications are to be prepared. One intent of the detailed specification, as a revision of the performance specification, is to provide sufficient detail to distinguish the features of one design solution for an item from other competing design solutions. Another intent is to specify details of the design solution, such as the use of specific parts and materials, that are essential for critical, safety or economic reasons, but to state as many requirements in performance terms as possible. When the Government baselines a detail specification, it limits its re-procurement choice to a particular design solution; and when a contractor agrees to that baseline, some design change flexibility is surrendered. What makes a stated requirement a design requirement and not a performance requirement is that it prescribes design, construction, material or quality control solutions, rather than allow contractor development flexibility.

3.4.3 Design Solution Document Concepts

The requirements of the functional and allocated baselines ***[See 3.5]*** are basically design constraints on the development contractor. The design solution evolves from the contractor's design and development process during the engineering and manufacturing development phase of the life cycle. This process essentially converts the performance requirements of the baseline specification into a specific product definition that can be manufactured to produce a hardware item or compiled to produce a software item. It is documented in design documentation for the hardware and the software comprising each CI.

For hardware, the design documentation may be in the form of engineering drawings and associated lists, and the material and process documents that are referenced from the drawings. In the current information environment, the primary design documentation source may be in the form of two or three dimensional engineering models. In that case, a drawing is simply a two dimensional view of a model that exists in a data base file. Various models and product modeling tools may be employed. Engineering drawings may or may not exist as a central part of the product manufacturing process, depending on the product and the degree of automation technology employed.

In an automaed development and production environment, an item is designed on the engineer's workstation, manufacturing instructions are added at the manufacturing planner's workstation and the results are fed directly to

automated machinery which produces the item. Where engineering drawings are required as a contract deliverable, they are plotted out for that purpose. Commonly, items are designed using computer-aided design tools (CADAM, CATIA, AUTOCAD, etc.) and engineering drawings are plotted for human checking and review.

For software, the design evolves through a software engineering process, using a variety of integrated tools, often called the software engineering environment, e.g., Computer-aided software engineering (CASE). The process results in computer based versions of documentation **[See *Activity Guide:* Table 3-9. Software Documentation,]** source and executable code for every CSCI. The process the contractor employs to manage the automated software documentation (e.g., software library management and archiving) is similar to the process used to manage automated hardware documentation, although different tools may be employed. Upon close examination, it is fundamentally the same process used to manage the files which contain software code. That is why, in MIL-STD-2549, you will find the same business rules applied to both software and documents in terms of their identification and relationships to other entities. **[Section 7 and Appendix B]**

Acquisition reform has essentially freed the contractor to evolve the most efficient methodology for evolving the design solution in a way that is appropriate to the scope and complexity of the particular product or product line. It is important for the acquisition program manager to recognize that there will be a great deal of diversity in the methodologies employed by various contractors, although there will also tend to be a great deal of similarities within given industry segments such as aerospace. Where it is necessary for the Government to capture the detailed design, the business rules of MIL-STD-2549, implemented in a Government CM AIS, will provide the means for a contractor to map the information in his internal data bases to the appropriate fields of the Government's CM AIS. **[Section 5 and Appendix B]**

The developmental configuration documentation to be managed by the development contractor consists of the design and technical data under the contractor's internal control. Some of this data may transition to Government configuration control and be designated as the Government Product Baseline; some of it may remain under Contractor configuration control and be designated as Contractor Product Baseline. **[3.5.1, 3.5.2]** The developmental configuration management process implemented by the development contractor consists of a formal process to control the documentation and repositories containing the elements of the developmental configuration. The contractor's engineering release system **[Details: 3.7]** and engineering release records are an important part of this management process. Each and every version of all elements of the developmental configuration released, for whatever purpose, should be maintained, along with the reasons the version was released, and the rationale for superseding the previous version.

3.4.4 Design Solution and Software Documentation Activity Guides

Tables 3-8 and 3-9 provide detailed information concerning the documentation used to document the design solution.

Table 3-9 also contains a complete set of software documents that are used for planning, system and software requirements analysis, software integration and testing, software product definition, operation and maintenance in addition to design description. Several software design description documents can evolve from earlier versions used to support one or more of these other functions. The Government needs access to some of these documents to the extent necessary for logistic support and software maintenance during the operational support period. This activity guide therefore addresses the documentation that can evolve over the full life cycle of a system/CSCI.

Detailed design documents for the CIs and CSCIs that the Government will support will be made accessible from a Government repository (e.g., JEDMICS). Meta-data concerning these documents will be available from CM AIS provided that the information that the Government requires the contractor to load into these systems is specified in the contract. **[Section 5, Section 7 and Appendix B]**

1

Activity Guide: Table 3-8. Engineering Drawings and Associated Lists

Subject	
Sub-topic/Reference	**Description**
Definition	
• MIL-STD-100 • ASME Y-14.1 • ASME Y14.24. • ASME Y14.34 • ASME Y14.35 • ASME Y14-100M • MIL-PRF-31000	A drawing is an engineering document or digital data file that discloses the physical and functional requirements of an item (directly by means of graphic and textual presentations, or by reference). Drawings communicate a variety of information, both textual or graphic. All drawings have certain common elements. Normally several types of engineering drawings combined into sets with associated lists are required to completely define the end-product requirements of an item. Drawings may be categorized into the following **MIL-PRF-31000** Technical Data Package (TDP) elements: - Conceptual design drawings - Developmental design drawings - Product drawings - Commercial drawings - Special inspection equipment drawings - Special tooling drawings
Drawing Types & Applications	
• ASME Y14.24M • MIL-STD-100	• **Detail, assembly, control, installation and diagrammatic drawings** - as necessary, provide engineering description and control of product attributes. • **Ancillary drawings** (drawings supplementing end-product drawings) and special application drawing types aid logistics, configuration management, manufacturing, or other functions. • **Additional DoD-unique types:** procurement control, design control, vendor item control, microcircuit drawing set, paint scheme, software, transportability, camouflage basis and pattern, combination of adopted items, kits, package content
Common Drawing Sheet Sizes and Format	
• ASME Y14.1 • ASME Y14.1M Note: In this instance there are separate documents for english and metric units respectively	• **Drawing sheet sizes -** Standard sizes for engineering drawing sheets. e.g. A, B, C, etc. • **Title block** - Design activity name and address, drawing title, drawing number, drawing size, CAGE Code, drawing scale, drawing sheet size, number of sheets (for a multi-sheet drawing). Most formats include drawing approval authority and angle of projection symbols. • **Revisions block** - Usually in the upper right hand corner. See Revisions to drawings, below. • **Optional blocks** - Additional blocks may be included on a drawing format adjacent to the Title Block. Examples: Application Block and Mechanical Properties Block
Drawing Variables	
• ASME Y14.1, 14.1M • MIL-STD-1840 (Gen) • MIL-PRF-28000 (IGES) • MIL-PRF-28001 (SGML) • MIL-PRF-28002 (Raster) • MIL-PRF-28004 (PDES) • ASME Y14.100M • MIL-STD-100[1]	• **Media** – **Hard copy** - Single sheet, multi-sheet, tabulation, book-form, drawings for microcircuits – **Digital -** Magnetic tape, Raster Image, IGES, PDES/STEP representations • **Format** – **Contractor** - Contractor title block, CAGE code and process – **Government** - For repetitive re-procurement of identical items, Government title block, CAGE code and release control • **Detail options** – **Mono-detail** - Each drawing covers a single part or assembly – **Multi-detail** - A drawing may cover an assembly and detail parts • **Dimensioning and tolerancing** - Several conventions may be chosen

[1] MIL-STD-100 supplements ASME Y14.100M (which reflects industry practice) for specific essential DoD requirements.

Activity Guide: Table 3-8. Engineering Drawings and Associated Lists

Subject	
Sub-topic/Reference	**Description**
	• **Drawing notes -** Short, concise statements providing clarification. They may apply to the entire drawing or any portion of the drawing. Notes do not include contractual requirements or requirements for data submission, approval or distribution. Preferably Notes are located on sheet 1 of the drawing, or direction is included on sheet 1 indicating location of notes, i.e. on parts list, or separate associated list.
Associated Lists	
• ASME Y14.34M • MIL-STD-100	• **Parts list** - a tabulation of all parts and bulk materials (except those materials which support a process) used in the item to which the list applies. Parts Lists may be Integral Parts Lists, prepared and maintained as part of the actual engineering drawing, or Separate Parts Lists, prepared as a document separate from the drawing with which it is associated and maintained independently from that drawing. • **Data list** - a tabulation of all engineering drawings, associated lists, specifications, standards, and subordinate data lists pertaining to the item to which the data list applies • **Indentured data list** - that is structured by successive assembly level • **Index list** - a tabulation of data lists and subordinate index lists pertaining to the item to which the list applies • **Wire list** - a tabulation of all the wires in an assembly which indicates their identification and terminations • **Application list** - a tabulation of parts and the next higher assemblies into which they install. (Commonly referred to as a where used list.)
Revisions to Drawings	
• ASME Y14.35M • MIL-STD-100	• Drawing revision identification • Any change to a drawing, including a change to Rights-in-Data, must be recorded in the revisions block of the affected drawing. • Record revision status, identification of change authorization documents, or description of changes, and change approvals, and if multi-sheet, revision status of sheets **Note:** If revision history is maintained in a data base, common practice is to provide it as part of an associated list (e.g. parts list) or via data base access rather than on the field of the drawing
Numbering Coding and Identification	
• ASME Y14.100M • MIL-STD-100	• Drawing and part identification rules liberal enough to accommodate a wide variety of industry practices. Any keyboard characters allowed. • Limited to precise drawing and part identification discipline necessary to provide unique identification for military equipment (e.g. use of CAGE codes, part identity keyed to drawing identity) • Original and current design activity; design disclosure, delivery of drawing originals • Drawing title conventions • Special markings, symbols and part/item replacement notations • Marking for shipment and storage • Special items and processes (e.g. system safety, electrostatic discharge) • Type designators
Drawing Requirements Manual (DRM); Tailoring and Application Guides	
• ASME Y14.100M • MIL-STD-100	• Drawing or Drafting Manuals are a reference defining in-house practices and extent of applicability of Standards. Government activities use tailoring or application guides. • The DRM, guides, standardize drawing form and presentation, facilitate communication (of intent and technical detail), assure consistent quality, simplify training, and provide a basis for improving practices.

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Activity Guide: Table 3- 9. Software Documentation

SW Life Cycle Process[2] (Engineering View/ Development Process) Purpose			
Acronym[3]	DOCUMENT[4] Description (Keywords)	MIL-STD-961D Equivalent [See 3.4.1, 3.4.2]	Config Doc? Baseline? [See 3.5.1, 3.5.2]
Process Implementation - Planning			
OCD	*Operational Concept Document* - proposed system; user needs	• No MIL-STD-961 equivalent : These documents are not specifications	• Not configuration documentation. • Data Control Only (i.e. Baseline internal to developer for document, document representation and file management purposes only.) [See Section 7]
SDP	*Software Development Plan* - development effort; process, methods, schedules, organization, resources. (Includes or refers to SCM & SQA plans)		
STP	*Software Test Plan* - Qualification testing; SW item; SW system; environment, tests, schedules		
SIP	*Software Installation Plan* - installing SW; user sites; preparations; training; conversion		
STrP	*Software Transition Plan* - transitioning to maintenance organization; HW; SW; resources; life cycle support		
System Requirements Analysis & Architectural Design			
SSS	*System/Subsystem Specification* - Specifies system or subsystem requirements; requirement verification methods. (May be supplemented with system level IRS)	• Program Unique System Performance specification	• Functional or Allocated Baseline
SSDD	*System/Subsystem Design Description* - system/subsystem-wide design; architectural design; basis for system development. (May be supplemented with IDD, DBDD)	• Part of Program Unique System Detail specification	• Design release[5]
Software Requirements Analysis & Design			
SRS	*Software Requirements Specification* - specifies SW requirements; verification methods. May be supplemented with IRS)	• Both part of Program Unique Software Performance or Detail Specification	• (Government or Contractor) Allocated Baseline for CSCI
IRS	*Interface Requirements Specification* - specifies interface requirements for one or more systems, subsystems, HW items, SW items, operations or other system components; any number of interfaces (Can supplement SSS, SSDD, SRS)		
Software Architectural and Detailed Design			
SDD	*Software Design Description* - SW item-wide design decisions; SW item architectural design; detailed design, basis for implementing[6]; information for maintenance (May be supplemented by IDD, DBDD)	• All are part of Program Unique Software Detail Specification	• All are Config Doc • Design release
IDD	*Interface Design Description* - interface characteristics; one or		

[2] Life Cycle processes in accordance with ISO/IEC 12207. Tailoring guidance: For a SW product embedded in a system, all life cycle process activity should be considered, relevant activities should be applied and tailored for each subsystem or configuration item; for a standalone software project, the system activities may not apply.
[3] Document types in accordance with EIA Standard 640/ IEEE Standard P1498 which are merging into Joint Standad 016, the US implementation of ISO/IEC 12207
[4] EIA Standard 640, et al, emphasize that the documentation is variable and tailorable to fit the project. Other documentation that meets the intent is acceptable.
[5] Contractor design release baseline; alias development configuration, release record
[6] Coding and testing the SW

Activity Guide: Table 3- 9. Software Documentation

SW Life Cycle Process[2] (Engineering View/ Development Process) Purpose			
Acronym[3]	DOCUMENT[4] Description (Keywords)	MIL-STD-961D Equivalent [See 3.4.1, 3.4.2]	Config Doc? Baseline? [See 3.5.1, 3.5.2]
	more systems, subsystems, HW items, SW items, operations or other system components; any number of interfaces; detail companion to IRS; communicate and control interface design decisions (Can supplement SSDD, SDD,)		
DBDD	*Data Base Design Description* - data base design; related data, files, SW/data base management system for access, basis for implementation and maintenance		
Software Integration and Qualification Testing			
STD STR	*Software Test Description* - test preparations; test cases; test procedures; qualification testing SW item, SW system or subsystem *Software Test Report* - record of test performed; assess results.	• No MIL-STD-961 equivalent:. These documents are not specifications	• Not configuration documentation. • Data Control • Evaluate change to config docs for impact on these test docs
As-Built Software Product Definition			
SPS	*Software Product Specification* - Contains or references executable SW, source files; SW maintenance information; "as-built" design information,[7] compilation, build, modification procedures; primary SW maintenance document	• Part of complete Program Unique Product Detail specification	• Product baseline; either Government or Contractor
SVD	*Software Version Description* - identifies and describes a SW version; used to release, track and control each version	• No MIL-STD-961 equivalent: This document is not a spec	• Not baselined. Status Accounting record for released SW Version
System Operation			
SUM SIOM SCOM COM	*Software User Manual* - hands-on software user; how to install and use SW, SW item group, SW system or subsystem *Software Input/Output Manual* - computer center; centralized or networked installation; how to access, input and interpret output; batch or interactive. (With SCOM is alternative to SUM) *Software Center Operator Manual* - computer center; centralized or networked installation; how to install and operate a SW system (With SIOM is alternative to SUM) *Computer Operator Manual* - information needed to operate a given computer and its peripherals	• No MIL-STD-961 equivalent:. These documents are not specifications	• Not configuration documentation. • Data Control • Evaluate change to config docs for impact on these operator manuals
System/Software Maintenance			
CPM FSM	*Computer programming Manual* - Information needed by programmer to program for a given computer; newly developed; special purpose; focus on computer not on specific SW. *Firmware Support Manual* - information to program and re-program firmware devices in a system; ROMs; PROMs; EPROMs, etc.	• No MIL-STD-961 equivalent:. These documents are not specifications	• Not configuration documentation. • Data Control • Evaluate change to config docs for impact on these test docs

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[7] May be updated SDD, IDD, DBDD

3.5 Configuration Baselines

The concept of baselines is central to an effective configuration management program; it is however, not a unique configuration management concept. The idea of using a known and defined point of reference is commonplace and is central to an effective management process. The essential idea of baselines is that in order to reach a destination it is necessary to know your starting point. In order to plan for, approve or implement a configuration change, it is necessary to have a definition of the current configuration that is to be changed. In order to manage a program effectively it is necessary to baseline the objectives for cost, schedule, and performance.

The Acquisition Program Baseline (APB), established at Milestone I and refined at Milestones II and III **[Ref: DODI 5000.2; Recall Fig. 2-5.]** provides the Program manager with key cost, schedule, and performance objectives and thresholds, which if not met, would require a re-evaluation of alternative concepts or design approaches. This baseline bears a close relationship with the configuration baselines described in this section. The performance thresholds in the APB must be reflected in the system or top level CI specification that constitutes the functional baseline for the program for those thresholds to be achieved.

In configuration management, a configuration baseline is a fixed reference configuration established by defining and recording the approved configuration documentation for a System or CI at a milestone event or at a specified time. Configuration baselines represent:

- Snapshots which capture the configuration or partial configuration of a CI at specific points in time
- Commitment points representing approval of a CI at a particular milestones in its development
- Control points which serves to focus management attention.

3.5.1 Configuration Baseline Concepts

Major configuration baselines known as the functional, allocated, and product baselines as well as the developmental configuration, are associated with milestones in the life cycle of a CI. Each of these major configuration baselines is designated when the given level of the CI's configuration documentation is deemed to be complete and correct, and needs to be formally protected from unwarranted and uncontrolled change from that point forward in its life cycle. Under MIL-STD-973 and earlier configuration management standards, these baselines all signified departure points for Government configuration control; they must now be redefined for post acquisition reform application because either Government or Contractor configuration control may apply. The new definitions reflect the same purpose for each baseline, however the configuration control activity (which approves of changes to the baseline) is treated as a separate variable **[Details: *Activity Guidelines*: Fig. 3-4a.-e.]**

- Functional baseline - The approved configuration documentation describing a system's or top level configuration item's performance (functional, inter-operability, and interface characteristics) and the verification required to demonstrate the achievement of those specified characteristics.

- Allocated baseline -The current approved performance oriented documentation, for a CI to be developed, which describes the functional and interface characteristics that are allocated from those of the higher level CI and the verification required to demonstrate achievement of those specified characteristics.

- Development configuration - the contractor's design and associated technical documentation that defines the contractor’s evolving design solution during development of a CI. The developmental configuration for a CI consists of that contractor internally released technical documentation for hardware and software design that is under the developing contractor's configuration control.

- Product baseline - The product baseline is the approved technical documentation which describes the configuration of a CI during the production, fielding/deployment and operational support phases of its life cycle. The product baseline prescribes:
  - All necessary physical or form, fit, and function characteristics of a CI,
  - The selected functional characteristics designated for production acceptance testing, and

- The production acceptance test requirements

When used for re-procurement of a CI, the product baseline documentation also includes the allocated configuration documentation to insure that performance requirements are not compromised

Each configuration baseline serves as a point of departure for future CI changes. The current approved configuration documentation constitutes the current configuration baseline. Incremental configuration baselines occur sequentially over the life cycle of a CI as each new change is approved. Each change from the previous baseline to the current baseline occurs through a configuration control process. **[Details: Section 4]** The audit trail of the configuration control activity from the CI's original requirements documentation to the current baseline is maintained as part of configuration status accounting. **[Detail: Section 5]**

From a government acquisition program perspective, the functional baseline is established when its associated functional configuration documentation is approved by the Government. This baseline is always subject to Government configuration control. The functional baseline consists of the functional configuration documentation (FCD) which is the initial approved technical documentation for a system or top level CI as set forth in a system specification prescribing:

- All necessary functional characteristics.
- The verification required to demonstrate achievement of the specified functional characteristics.
- The necessary interface and inter-operability characteristics with associated CIs, other system elements, and other systems.
- Identification of lower level CIs, if any, and the configuration documentation for items (such as items separately developed or currently in the inventory) which are to be integrated or interfaced with the CI,.
- Design constraints, such as envelope dimensions, component standardization, use of inventory items and integrated logistics support policies.

The Governments functional baseline is usually defined as a result of Phase I, Program Definition and Risk Reduction, when a Phase I is included in the acquisition strategy. In the absence of a Phase I, the functional baseline is established at the beginning of Phase II, Engineering and Manufacturing Development. From a contractor’s point of view, a functional baseline, whether formally established or not, is always in place at the inception of Phase II. It is represented by whatever documentation is included or referenced by the Phase II contract to define the technical/performance requirements that the contractor’s product is obligated by the contract to meet.

The allocated baseline is, in reality, a composite of a series of allocated baselines. Each allocated baseline consists of the allocated configuration identification (ACI) which is the current approved performance oriented documentation governing the development of a CI, in which each specification:

- Defines the functional and interface characteristics that are allocated from those of the system or higher level CI.
- Establishes the verification required to demonstrate achievement of its functional characteristics.
- Delineates necessary interface requirements with other associated CIs, and
- Establishes design constraints, if any, such as component standardization, use of inventory items, and integrated logistics support requirements.

The requirements in the specification are the basis for the contractor's design of the CI; the quality assurance provisions in the specification form the framework for the qualification testing program for the CI. The initial allocated baseline may be established at the end of Phase I, Program Definition and Risk Reduction, or early in phase II, Engineering and Manufacturing Development. The allocated baseline for each CI is documented in an item performance (or detail) specification, generally referred to as a development specification.

The specification(s) defining each allocated baseline is subject to configuration control by either the Government or by the contractor. The configuration control activity determination is very simply made as follows:

- The Government is the configuration control authority for those allocated specifications/baselines that have been issued, or approved by the Government. The Government will control the specifications for CIs that it will organically provide logistic support

- The contractor will be the configuration control authority for the allocated specifications for CIs at a lower level that it will logistically support.

Based on the definition of the functional, allocated and product baselines as Government baselines, there has always been considerable confusion as to what to call the baseline established between a contractor and a sub-contractor. From the contractor's point of view, it is an allocated baseline. From the sub-contractor's view, it is a functional baseline since it constitutes the top level requirement that he must meet, and which he may need to allocated further down the CI tree**[Fig. 3-2]**. Whether this baseline is considered a functional baseline, an allocated baseline, or a functional/allocated baseline is immaterial so long as the configuration control requirements for the related configuration documentation are clearly established.

Interface control documents**[See 3.8]** are considered part of the functional and/or allocated baselines to the extent that they are referenced in and supplement the performance specifications that constitute the applicable baselines.

Contractor implementation of the functional and allocated baseline requirements involves the creation, and release of engineering documentation that incrementally defines the configuration of the specific product. It represents the contractors detailed design solution. It may or may not include a detail specification for the product. The contractor is responsible for the configuration control of the developmental configuration and may iteratively design, release, prototype and test until the functional and allocated requirements are satisfied. The developmental configuration will ultimately include the complete set of released and approved engineering design documents, such as the engineering drawings and associated lists for hardware and the software, interface and database design documents for software. By reference within this documentation, it also includes test and verification documents

The product baseline is the approved documentation which completely describes the functional and physical characteristics of the CI, any required joint and combined operations inter-operability characteristics of a CI (including a comprehensive summary of the other environment(s) and allied interfacing CIs or systems and equipment). It consists of the Product Configuration Identification (PCI) which is the current approved technical documentation describing the configuration of a CI during Phase III, the Production, Fielding/Deployment and Operational Support phase of its life cycle. The product baseline prescribes:

- All necessary physical or form, fit, and function characteristics of a CI,
- The selected functional characteristics designated for production acceptance testing, and
- The production acceptance test requirements
- All allocated configuration documentation pertaining to the item, so that if the item were to be re-procured, the performance requirements for the item would also be included.

The product baseline documentation includes the complete set of released and approved engineering design documents, such as the engineering models, engineering drawings and associated lists for hardware; and the software, interface and database design documents for software. These are the then current configuration of the documents that were considered the developmental configuration. The product baseline may include the 2-D or 3-D engineering model of a hardware product, and for software, it includes a representation of the CSCI source code. It also includes by reference, the material and process specifications invoked by the engineering documentation.

The configuration control authority for the product baseline for each CI is determined with the same supportability test as the allocated requirements, described above. The Government needs to take delivery of and control product configuration documentation at a level of detail commensurate with the operational, support and re-procurement strategies for the given program. For repairable CIs developed wholly or partly with Government funding, design disclosure documentation is required to the lowest level at which the CI will be operated, maintained, repaired, trained, supported and re-procured.A significant factor in this determination is data which is properly established as "Contractor proprietary." The Government shall determine if it is necessary and cost effective to buy rights to the data, do without it, develop new data and CIs, or return to the original contractor whenever re-procurement or support of the CI is needed. When a CI is wholly developed with private funding and is acquired by the Government, the data normally available for the item (typically form, fit and function documentation) is evaluated and included in the appropriate baselines.
.

The functional, allocated, and product configuration documentation must be mutually consistent and compatible. Each succeeding level of configurationidentification is a logical and detailed extension of its predecessor(s). The specification structure of MIL-STD-961D, Appendix A, facilitates this congruence since a separate specification is not created when a performance specification transitions to a detailed specification **[3.4.1, 3.4.2]**. Redundant documentation should be avoided to minimize the possibility of conflicts. If a conflict arises between levels of configuration documentation, the order of precedence is always FCD, ACD, PCD.

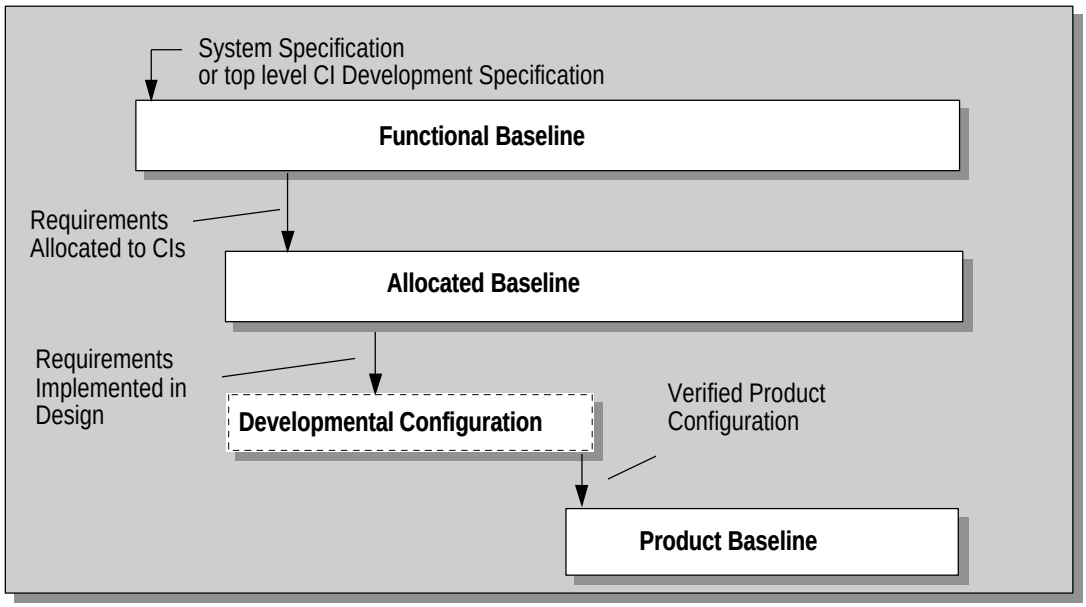
When viewed on a system basis, however care must be exercised to assure that all of the top level requirements are accounted for in individual lower level documents. This is a key function of such reviews as system, preliminary and critical design reviews but is greatly facilitated by the use of automated requirements allocation and traceability tools.

3.5.2 Configuration Baseline Activity Guides

As can be seen from the above discussion, performance oriented acquisition strategy has introduced considerable flexibility into the configuration baseline process. There will however be a long period of transition as pre-existing programs either phase into the new methodology or complete their life cycle under prior acquisition strategy. In many programs there will continue to be a mix of philosophy, as dictated by the results because of cost trade-offs. The application guides in this section, therefore reflect a variety of baseline methodologies which may be contractually in place.

Figures 3-4a. and b.reflect the two latest revisions of MIL-STD-973. **Fig. 3-4a** also reflects the baseline concept of MIL-STD-480B, MIL-STD-482, etc, which preceded MIL-STD-973. These standards have been superseded but continue to effect follow-on legacy system contracts where it is not cost effective to upgrade to new standards. **Fig. 3-4c** reflects the baseline concept of EIA/IS-649, the National Consensus Standard for Configuration Management. It is viewed from the industry perspective as the baselines that a contractor would establish for himself to manage his product. It is compatible with and maps easily to any of the other baseline concepts. **Figs 3-4d. and 3-4e** illustrate the performance based acquisition baseline concepts described in **3.5.1.** They show several of the flexible options the Government may exercise based on acquisition strategy, logistic support planning and sound management judgment.

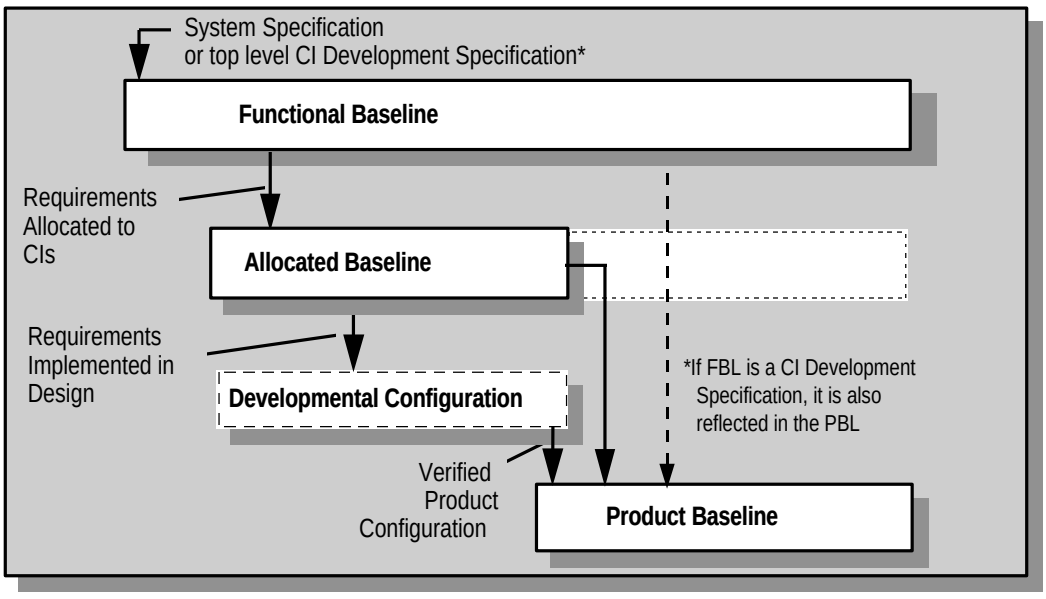
Figure 3-4a. *Activity Guide:* MIL-STD-973 Baseline Concept



Description:

- Functional, allocated and product baselines under Government configuration control; developmental configuration under contractor configuration control
- Three baselines maintained concurrently during Production, Fielding/Deployment and Operational support

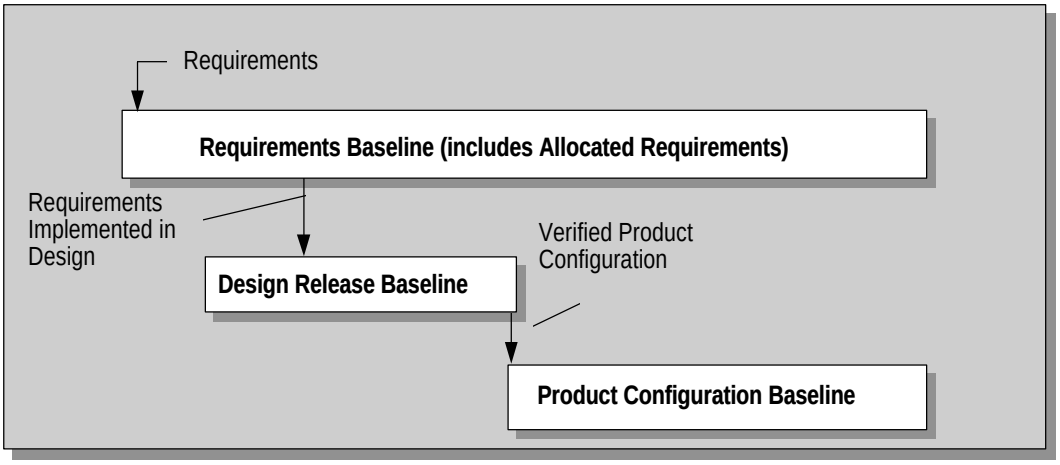
Figure 3-4b. *Activity Guide:* MIL-STD-973, Notice 3 Baseline Concept



Description:

- Same as Fig. 3.4a, except that Product baseline incorporates the ACD describing a CI's functional, performance, interoperability and interface requirements and the verifications required to confirm the achievement of those specified requirements

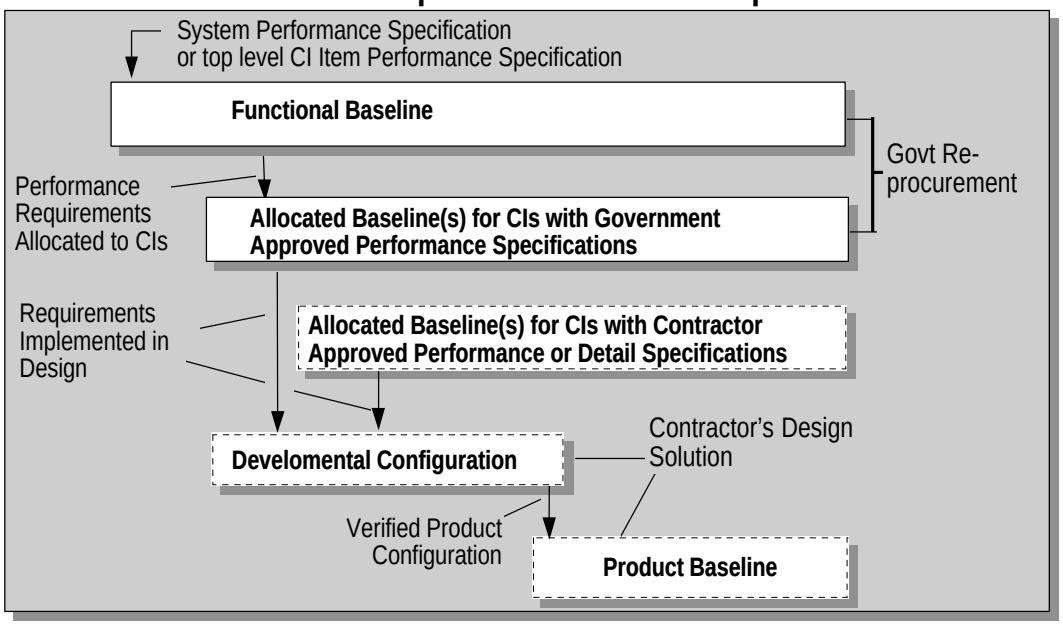
Figure 3-4c. *Activity Guide:* EIA 649 Baseline Concept



Description:

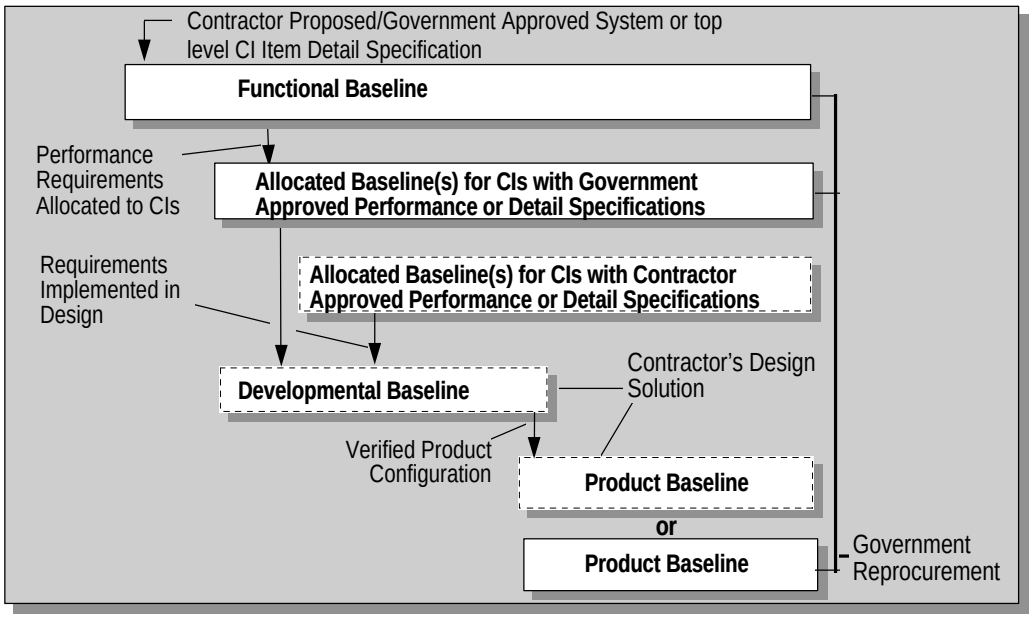
- Requirements Baseline is the customer baseline, whether the customer is external or internal to the organization. It includes any allocated requirements since they are merely a next level requirements baseline
- Design Release Baseline is similar to the Developmental Configuration in Figs. 3-4 a. and b.
- Product Configuration Baseline is similar to the Product baseline in Figs. 3-4 a. and b. It is always controlled by the developing contractor
- Conceptually this Schema readily maps to any Customer baseline concept. If a contractor is using this concept, his system should be compatible.

Figure 3-4d. *Activity Guide:* Performance-Based Acquisition Baseline Concept - Scenario 1



Description: In this scenario, the Government does not take control of the Product baseline. The other major difference caused by acquisition reform is that there are some allocated requirements controlled by the Government; some by the contractor. The Government re-procures to performance requirements only.

Activity Guide: **Figure 3-4e.**
Performance-Based Acquisition Baseline Concept - Scenario 2



Description: In this scenario, the Government may take control of some or all of the Product baseline and some allocated baselines contain detail item specifications.The Government re-procures to combined functional, allocated and product baselines

3.6 Document and Item Identification

This section describes the concepts for the assignment of identifiers to CIs, component parts and their associated configuration documentation. Clearly identified items and documentation are essential to effective configuration management throughout the life cycle, particularly during the deployment and operational support period when the marking on a part is the key to installing a correct replacement part and finding the proper installation, operation and maintenance instructions.

3.6.1 Document Identification Concepts

A document identification principle expressed in EIA/IS-649 is that each configuration document (as well as other documents) must have a unique identifier so that it can be associated correctly with the configuration of the item to which it relates. The DoD and all Military components use the following three elements to assure the unique identity of any document: CAGE code, document type and document identifier. In addition, revision number and/or date clearly specifies a specific issue of a documen**t[Detail: 3.6.4, *Activity Guidelines*: Table 3-10]**

A document can have many representations, as for example a word processor file and a paper copy; a CAD file and a representation of that CAD file inserted in a document. In addition to the identification assigned to each document, the digital files for each version of each representation of the document, and its component files must be identified and managed.**[Detail: Section 7, Data Management]**

It is the responsibility of each individual assigned to manage an item of configuration documentation to employ the appropriate procedures of his organization which ensure:

- The assignment of identifiers to the configuration documentation, including revision and version numbers when appropriate; and procedures to control the engineering release of new/revised data**[Refer to 3.6.2 and 3.7]**
- The application of applicable restrictive markings**[Detail: 3.6.2, *Activity Guide*: Table 3-10]**

3.6.2 Document Identification Activity Guides

Table 3-10 provides document identification detail.

Activity Guide: Table 3-10. Document Identification

Identifier Element	Definition
Document Identifier	
CAGE Code	CAGE Code identifies the source of the document. CAGE codes are provided in **Defense Logistic Agency (DLA) Cataloging Handbook H4/H8 Series.** CAGE codes are affixed to all CIs, and their *replaceable* subordinate parts and assemblies. They are also part of the identification marking of each item of configuration documentation, software media and software product.
Document Type	For purposes of entering information about configuration documents into the CM AIS system, there is a series of standard document identifiers and document type codes to be used along with the CAGE and document number. These codes do not in any way restrict the ability of the preparing activity to identify documents. Rather they provide standard data base data element identifiers so that each document reference can be entered into the proper field and bear the correct relationships to other fields of information. These code names will be largely transparent to the originating and using organizations. They will be employed primarily in the translation and mapping of information from one automated system/data base to another using a universal data element framework. **[See 5.2, 7.2.1, and Appendix B]**
Document Identifier	The document Identifier distinguishes one document produced by the organization referenced by the CAGE code from another. Each document and each revision thereto, requires the document identifier. There are as many schemes for identifying documents as there are organizations producing them, so there is no standard format for all documents. There are however, a few common sense constraints on the numbering content for some specifications, and engineering drawings, as defined in applicable standards
Revision/Version identifier	
Revision Number	Revision Number clearly establishes which issue of a particular document is current or applicable.
Version Number	Conceptually the same as revision, version is the term typically used for files
Date	Date is an additional discriminator. It is good common sense business practice to date every document and every revision
Restrictive Markings: ***These requirement apply to digital data files and digital media as well as to paper documents and are all intended to limit the access to such data to those entitled to access them.*** **[Ref: DoD FAR Supplements 252.227-7013, 7018, 7032 and -7037]**	
Security Markings	Security markings are required to be clearly marked on all classified data and special handling requirements apply. Each contract contains classification guidance and direction, which must be strictly adhered to.
Distribution Statements	Specific distribution statements and export restrictions must be marked on information subject to secondary distribution limitations as prescribed by law and as indicated by the contract. The purpose of these markings is to inform the secondary distributor, such as a Government repository whether they can legally provide the subject information to third parties, and if the data are allowed to be exported to foreign countries.
Data Rights	Documents which contain data for which the Government or other parties do not have unlimited rights, must be appropriately labeled to indicate the data rights limitations, so that proprietary information disclosed to the Government for specific purposes is protected .

3.6.3 Item Identification Concepts

The following principles in EIA-649 apply to the Identification of Configuration Items; the terminology in parentheses are the common terms used in the defense, aerospace and electronics industries):

- All products (Configuration Items) are assigned unique identifiers (e.g., Nomenclature, CAGE, Part/Item Number) so that one product can be distinguished from other products; one configuration of a product can be distinguished from another; the source of a product can be determined; and the correct product information can be retrieved.
- Individual units of a product are assigned a unique product unit identifier (Serial Number) when there is a need to distinguish one unit of the product from another unit of the product.
- When a product is modified, it retains its original product unit identifier (Serial Number) even though its part identifying number is altered to reflect a new configuration.
- A series of like units of a product is assigned a unique product group identifier (Lot Number) when it is unnecessary or impracticable to identify individual units but nonetheless necessary to correlate units to a process, date, event, or test.

Contractors assign identifiers including serial and lot numbers to CIs and their component parts, as necessary to establish the CI effectivity of each configuration of each item of hardware and software. Items are marked or labeled with their applicable identifiers to enable correlation between the item, its configuration documentation, and other associated data, and to track maintenance and modification actions performed. Thus, serial and lot numbers are also known as tracking identifiers. For software, applicable identifiers are embedded in source and, when required, in object code and in alterable read-only memory devices (firmware).

a. Military Nomenclature and Nameplates.

The contract should specify requirements for the assignment of Government type designators and Nomenclature to CIs for which the Government needs to control, track and provide logistic support. Government Nomenclature is requested by a contractor and is included on CI nameplates**[Detail: 3.6.4 *Activity Guide:* Table 3-11]**

b. Part/Item Identification Numbers (PIN)

A discrete part/item identification number (PIN), generally referred to as a part number, is assigned by the developing contractor to each CI and its subordinate parts and assemblies. The part number of a given part is changed whenever a non-interchangeable condition is created.

Part number format is at contractor option and a wide variety of formats are employed. The standard constraint within the defense industry had been a limitation to no more than 15 characters including dash numbers. However, with the increasing use of commercial items that are not so limited, MIL-STD-2549 and many current systems accomodate 32 characters. Some contractors employ a mono-detail system in which one part is detailed on one drawing, and the drawing and the part number is the same. For practical reasons, others employ a multi-detailing system in which the drawing number may detail several parts and assemblies. In this case, the drawing number is a base to which dash numbers are assigned for discrete parts controlled by that drawing.

The significant criteria is as expressed in the principles above: The part number must uniquely identify the specific part and unless otherwise specified, all CIs including parts, assemblies, units, sets and other pieces of military property are marked with their identifiers.**[Detail: 3.6.4, *Activity Guide*: Table 3-11][Reference: MIL-STD-100, MIL-STD-129, MIL-STD-130]**

c. Software Identifiers

For each CSCI, the software identifier consists of a name or other identifier and a version identifier. The identifiers relate the software to its associated configuration documentation (software requirements specification, software design documents, etc), revision and release date. The software and version identifiers are embedded within the

source code, and are marked on media containing the software. A method is typically employed to display the identifier and version to the user of the software upon command.

In a structured analysis and design approach to software development the contractor asssigns identifiers, which are usually mnemonic in form) to the software units below the CSCI level.

Firmware is labeled on the device or, if the device is too small, on the next higher assembly. **[Details: 3.6.4, Activity Guide: Table 3-11]**

d. Serial and Lot Numbers

CIs are the address for effectivity of subordinate parts, and for the effectivity of changes to subordinate parts. This means that the effectivity of a part is expressed in terms of the range of serial numbers of the CI end item into which it is assembled.

Note: There are other ways of expressing the effectivity, particularly in commercial industry, but whether lot, block, FY contract, date or other term is used, it must translate as closely as possible to which serial numbered CIs will have the part installed.

There are also several kinds of related serial numbers that are employed in a CI production phase. The Government normally identifies the serial numbers to be affixed by the contractor on Government designated deliverable CIs. Government serial numbers are in a variety of formats depending upon the type of equipment and the policy of the acquisition command.

Contractors assign serial numbers (sometimes referred to as shop numbers) to units in production. All engineering, manufacturing and quality data will refer to the shop numbers. These shop serial numbers may or may not correspond directly to the serial numbers to be marked on parts or nameplates (delivery numbers), because for various reasons the shop units may not complete the manufacturing process in sequence, or some units in the flow may be sent to another customer. (Example: Two out of every three units of a system are supplied to the US Army, but the third unit is supplied to a foreign Government under a foreign military sale (FMS) contract.)

Where impractical, because of quantity or composition of the part or material, to serialize individual units, lot numbers are employed to identify a group of identical parts. Typically lot numbers are employed for subordinate parts below the CI level, but occasionally, they are appropriate at the CI level, as for example with rounds of ammunition. The lot numbers are controlled and are subject to the same constraints as the serial numbers.

The important factors, in evaluating a contractor's system of item identification is that:

- There is an effective process for controlling the effectivity of parts by serial number (either shop number or delivery number)
- A comprehensive cross-reference is maintained between the shop number of an item and its delivery serial number, or for lot-controlled items, between the manufacturing lot and the delivery lot.

[Details: 3.6.4, *Activity Guidelines*: Table 3-11]

3.6.4 Item Identification Activity Guide

Table 3-11 provides details about item identification, including hardware, software and firmware.

1

Activity Guide: Table 3-11. Item Identification

Identifier Element	Definition/Requirements
Item Identifiers	
Military Nomenclature	• Contract must specify items or types of items to be nomenclated • Nomenclature requested from Government: in accordance with _____ – Contractor assigns nomenclature in accordance with guidelines – Government approves nomenclature – Nomenclature is revised when necessary to account for a non-interchangeable condition
Part/Item Identification Number (PIN) **[Ref: MIL-STD-100]**	• Uniquely identify the item (when combined with CAGE code) **[See Table 3-10]** • All CIs, parts, assemblies, units, sets • PIN is the same as, or contains, drawing or other design document number • Assigned by developing contractor • Changed (e.g. new dash number) when part is modified and a non-interchangeable condition is created
Serial and Lot Numbers (Product tracking identifiers)	• Uniquely identify an individual unit or specific group of units of an item • When applied to CIs, are the basis for effectivity of subordinate parts • Government may designate serial numbers for deliverable CIs.[8] If no serial numbers are provided by the Government, the contractor will serialize each delivery unit according to his own system and convention. • Serial and Lot numbers are unique, consecutive and non duplicating for a specific nomenclature or part identifier. – The original serial number of a unit/item/CI is not changed even when a change affecting interchangeability may require rework and re-identification. – Once assigned, serial numbers and lot numbers are never re-used for the same item. This rule applies to all types of serial numbers including delivery serial numbers and shop numbers as well. – It applies to lot numbered items to the extent practicable; if rework occurs by lot, in different lots than original manufacture, this rule is may be broken with the understanding that traceability to the original lot is lost. – There should never be two items with the same part number and the same serial number • Serial and Lot Numbers must be assigned against a non-changing base, known as a product tracking base identifier. Part number is not an appropriate base for serialization because it is subject to change if the part is modified.
Software/Firmware Identifiers	
Software Identifier	• Each CSCI shall have an identifier consisting of a name or number, that is unique within the software system. It uniquely identifies the software when combined with the CAGE code and identifier for the system in which it installs. • Each Version of the Software CSCI shall have a version identifier supplementing the software identifier • Software units, at and below the CSCI level, are identified using developing contractor convention, typically the conventions of the software language in which it is written
Firmware Identifiers	• Where both the hardware device and the embedded code are documented and controlled via the same engineering design document (drawing), the PIN for the device with code embedded identifies the firmware • Where the hardware device and the software to be embedded are documented and controlled separately, The device is identified by a PIN and serial number; the embedded software is identified as

[8]One method used on avionic equipment is to assign a series of three or four digit code letters/numbers to each fiscal year contract as a prefix for the sequential serial numbers to be assign to each unit of the items to be delivered. Air vehicles normally have a block of serial numbers assigned for each contract.

Activity Guide: Table 3-11. Item Identification

Identifier Element	Definition/Requirements
	a CSCI
Hardware Marking and Labeling	
Nomenclated, Nameplated Items	• Contain the following identification information on their nameplates: – Nomenclature – Design Activity CAGE code and name – Part Number – Serial Number (Normally applicable; Lot Number if Serial Number is not applicable) – Manufacturer – Acquiring Government Activity – Contract Number under which it is acquired – National Stock Number, if applicable – Bar-coding, if specified, typically containing NSN and selected information above such as part and serial numbers
All Items large enough to legibly mark	• CAGE Code (or other industry source identifier, if applicable) • Part Number • Serial or lot Number, if applicable • Standard Number (MIL or commercial) if applicable
Small items	• Reference designator (on part or adjacent to it, as on a circuit board) relating the item to a documented record, or as in the case of electronic components to a an element on a schematic diagram
Specific electronic component types	• Striping, and or color coding, as on resistors and capacitors and other components, which indicate their values and tolerances according to industry standards
Software Marking and Labeling	
Software identifier and version identifier	• Are embedded in the source code for the CSCI • Means are provided to display identifiers for installed software to user upon software initiation or upon specific command • In mission critical situations, identification of the correct software version may be verified as part of system self-check; as well as during system test following equipment repair or maintenance.
Software media identifiers	• Each software medium (for example, magnetic tape, disk) containing copies of tested and verified software entities is marked with a label containing, or providing cross-reference to, a listing of the applicable software identifiers of the entities it contains. • Media for deliverable CSCIs are labeled with the Government contract number, the CAGE and CSCI software identifier, the CPIN (if any), and the media number (for example, 1 of 2, 2 of 2) if there are multiple units per set and copy number (Copy No. 1, 2, etc.) of the medium or media set (if there is more than one copy being delivered).
Firmware Marking and Labeling	
If PIN Identifies	• PIN representing the device with software embedded is marked on device, or if device is too small on an adjacent assembly
Embedded CSCI	• PIN of device (without embedded software) and serial number of device, if applicable, is marked on the device • CSCI SW identifier including version identifier for software is also marked on the device • SW identifier is also labeled on identification plate or decal located adjacent to the nameplate on the equipment containing the firmware

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3.7 Engineering Release

3.7.1 Engineering Release Concepts

Engineering release is an action that makes configuration documentation available for its intended use and subject to the contractor's configuration control procedures.

Configuration documentation that requires Government approval is subject to Government configuration control. The contractor’s engineering release process must prevent all engineering releases related to a class I change to a Government approved document from being released until the Government has approved the class I change. **[Details: Section 4]**

Acquisition program managers should ensure that both contractors and Government activities follow engineering release procedures which record the release and retain records of approved configuration documentation (engineering release records). These records provide:

- An audit trail of CI documentation status and history
- Verification that engineering documentation has been changed to reflect the incorporation of approved changes and to satisfy the requirements for traceability of deviations and engineering changes
- A means to reconcile engineering and manufacturing data to assure that engineering changes have been accomplished and incorporated into deliverable units of the CIs.

[Details: Activity Guide: Table 3-12. Engineering Release Record Content and Functional Capability]

It is probable during development that contractors would release several, progressively more detailed versions of specifications and drawings to their various functional areas or integrated product teams or to the Government (for technical reviews, progress reports). Configuration documents that require formal submittal to the Government for approval [Refer to Section 7] may be at an advanced revision level (Revision "G", for example) at the time of initial submittal. Under no circumstances is it prudent for the Government to ask a contractor to make his initial submittal of a document the “no-change” or initial revision, when it is not. By doing so, traceability to information that may become important at some future time could be lost.

Detail design documents under the contractor control must be kept current with all changes/modifications and releases including changes occurring as a result of test activity. The record of prior release and use history of configuration documentation represents the developmental history of the CI and may be needed to support cost trade-offs and the rationale for changes to design constraints. Release records should indicate superseded as well as superseding requirements at least until superseded configurations no longer exist. Superseded requirements then may be retained as historical information.

All approved Class I and II engineering changes released for production are identified by change identifiers. The change is documented and released prior to formal acceptance of the deliverable unit in which the engineering change is first installed. The contractor’s release process should verify the approval/concurrence status of each Class I/Class II change prior to the release of the related documentation for use in the generation of deliverable units. The release process and released documentation should identify engineering changes, and retain a record of superseded configuration requirements which are/were incorporated into delivered CIs.

Each approved Class I engineering change is incorporated into all units, or into complete blocks of units, within one mission, design, series or type, model, series of the CIs affected. Verification of the production incorporation of authorized engineering changes is accomplished for all CIs. Documentation of the actual released configuration for each CI at the time of its formal acceptance is retained in release records. This information is of particular importance, especially if there are warranties associated with the CI or its components.

Methods to ensure acceptable contractor engineering release systems include prior knowledge, through past performance, of the contractor's existing procedures, prior certification of the contractor's procedures; and a contractor's configuration management plan delineating his procedures.

During the operational support period, the Government will need design disclosure information on all CIs down to the level that will be supported by the Government. In addition, the Government may need additional design details prior to or at the end of Production, depending upon a number of factors such as:

- The need for continued support of operational items
- The type of specification to be used for re-procurement if re-procurement is anticipated **[Details: Activity Guide: Table 3-13. Government Acquisition of Detailed Design Data]**

In a CALS integrated data environment, selected information in a contractors release record may be shared by the Government or downloaded to the CM AIS. The actual documents also may be downloaded (as raster images) to the JEDMICS data depository. Until the transition to these standard systems is completed, a variety of methods are being employed to populate the databases being used by the various services. There is currently no standard engineering release system used by all Government activities.

3.7.2 Engineering Release Activity Guides

Table 3-12 is intended to be used to evaluate a contractors engineering release system from both a data content and a functional capability point of view.

Acquisition reform has affected the degree of detailed design and engineering release information that the Government needs to perform its mission **Table 3-13** addresses the various levels of detailed design data Government needs to acquire in a variety of circumstances.

Activity Guide: Table 3-12. Engineering Release Record Data Content and Functional Capability

Item	Elements of Data or Capability
Document Item	• Document Number • Title • CAGE number • Date of release • All released revisions • Date of release of each revision
Hardware Items CI elements	• CI identifier • Delivered CI serial numbers • Top assembly drawing number • CI specification identification number
Drawing elements	• Drawing number • Drawing title • CAGE number • Number of sheets • Date of release • All released change letters • Date of each change letter release • Change document number effecting each change letter release
Part number elements	• Controlling drawing number • Component part numbers released
Software items	• For software items, the content of a CSCI Version Description Document (VDD) is the equivalent of a release record for hardware **[Table 3-9]**

Activity Guide: Table 3-12. Engineering Release Record Data Content and Functional Capability

Item	Elements of Data or Capability
Functional capabilities i.e.. Information that should be obtainable from a combination of release records and released documentation (including drawings and associated lists) during production phase	• The composition of any part at any level in terms of subordinate part numbers • All next higher part numbers (or next assembly numbers) in which the part is used • The composition of any CI in terms of component part numbers and subordinate CI identifiers • The composition of any CSCI in terms of units and subordinate CSCIs • The item part number and serial numbers, if serialized, on which any subordinate provisioned part is used • The CI identifier and CI serial numbers (effectivity) on which any subordinate provisioned, or to be provisioned, part is used • Identification numbers of class I changes which have been released for any specific serial-numbered unit of a CI • Identification numbers of all class II changes which have been partially or completely released for any particular part, including week of incorporation • The CI identifiers and CI serial numbers, or CSCI version numbers, which constitute effectivity of each class I engineering change • The specification or standard, part numbers or nomenclature of all parts including subordinate supplier parts • The specification document, specification control drawing numbers, or source control drawing numbers associated with any supplier CI. • All active contracts on which any part is to be delivered separately or as a part of an assembly.

Activity Guide: Table 3-13. Government Acquisition of Detailed Design Data

Purpose	Type of Data	Level
CI Re-procurement	Performance Specification(s) Technical Data Package	Down to CI level supported organically None Required
CI Re-procurement of identical items	Detail Specification(s) Technical Data Package	CI Complete for CI and Replaceable parts
Provisioned item re-procurement	Technical Data Package	Each provisioned item
Assume support previously provided by contractor	Technical Data Package	Complete for all items for which support is being assumed
CI Operation, maintenance and repair	Technical Manuals	Covering CI down to the level of replaceable parts and organically repairable parts

3.8 Interface Management

Another aspect of configuration identification to be considered during development is interface management, also referred to as interface control. Acquisition program managers responsible for new systems may have interfaces with other systems. Those interfaces constitute design constraints imposed on the programs. As the system is defined, other interfaces between system components become apparent. All of the interfaces between co-functioning items need to be identified and documented so that their integrity may be maintained through a disciplined configuration control process. In some cases a formal interface management process must be employed in order to define and document the interface.

3.8.1 Interface Management Concepts

Interfaces are the functional and physical characteristics which exist at a common boundary with co-functioning items and allow systems, equipment, software, and data to be compatible. The purpose of all interface management activity is that:

- The detailed design of each of the co-functioning items contains the necessary information to assure that the items, when individually designed and produced will work together (as the 115-volt plug to the 115-volt electrical outlet), and
- If either item needs to be changed for any reason, its performance, functional or physical attributes, that are involved in the interface, act as constraints on the design change.

During development, part of the contractor's design effort is to arrive at and document external interface agreements, as well as to identify, define, control and integrate all lower-level (i.e., detailed design) interfaces. **Figure 3-5** illustrates many (but not all) of the possible interfaces that may exist between systems and within a system. Interfaces include external interfaces with other systems, internal interfaces between CIs that comprise the system, and internal interfaces between CIs and other components of the system (e.g., personnel, non-developmental items (NDIs), facilities). also inferred are the interfaces between acquiring activities and supplying activities. In some cases, interfaces between two or more acquiring activities must be established (See Interface ❸ in Figure 3-5 and Table 3-15.), typically by means of a Memorandum of Agreement between service components or commands with in a service component that are acquirers of or users of interfacing equipment.

To understand how a particular interface should be defined and managed, it is necessary to categorize the interface in a number of ways:

- Contractual relationship - Are the items supplied by the same contractor or by different contractors? If different contractors, is there, or will there be, a contractual relationship (such as a subcontract or purchase order) between the parties to the interface?
- Customer relationship (Acquisition activity(ies) - Is the same acquisition activity responsible for both interfacing entities or are different activities or even services involved?
- Hierarchical relationship - Is the interface at the system, CI, assembly, or part level?
- Type(s) and complexity of technical interface attribute(s) involved - Is the interface a mechanical, electrical, electronic, installation, data, language, power, hydraulic, pneumatic, space, operating range, frequency, transmission rate, capacity, etc. (to name a few)
- Developmental status - Is one both or none of the interfacing items a non-developmental item (NDI)? Do the interfacing items require parallel design and development?

Categorizing the interface in this manner defines the context and environment of the interface, and enables the appropriate measures to be taken to define and control it. Each interface must be defined and documented; the documentation varies from performance or detailed specifications to item, assembly, or installation drawings, to interface control documents/drawings. Some interfaces are completely managed within the design process; others require specific types of formal interface management activity. The simplest and most straightforward approach that will satisfy the above objective should always be chosen. Extravagant and complex interface management activity, should only be undertaken when other methods are inappropriate.

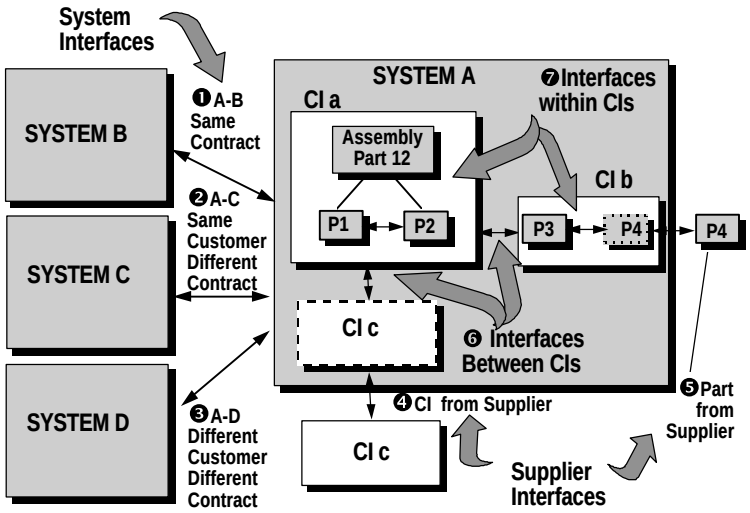

Figure 3-5. Understanding the Levels of Interface

Whether formal or informal interface management is employed, it is necessary that there be a legal responsibility on the part of the interfacing parties, since even the best intentioned technical agreements can break down in the face of fiscal pressure. If there is a contractual relationship, including a teaming arrangement, between two or more parties to an interface, there is already a vehicle for definition and control; however, where there is no contractual relationship, a separate interface agreement may be necessary to define the interface process and provide protection of proprietary information. When the agreement involves two or more contractors, it is referred to as an associate contractor agreement; when two or more Government activities are the parties to the agreement, a Memorandum of Understanding (MOU) is generally used.

Within an organization, and often with subcontractors, integrated product teams may be used to establish interfaces. Some interfaces must be defined through a formal interface management process involving interface control working groups (ICWGs). An ICWG is a specialized *integrated product team* comprised of appropriate technical representatives from the interfacing activities. It's sole purpose is to solve interface issues that surface and cannot be resolved through simple engineer to engineer interaction.

Once interfaces have been agreed-to by the parties concerned, they must be detailed at the appropriate level to constrain the design of each item and baseline the configuration documentation so that the normal configuration control process will maintain the integrity of the interface. Then it may be necessary to convene an ICWG or other mechanism on rare occasions to resolve change issues in a satisfactory manner. The Government is the arbitrator of issues that cannot be resolved by an ICWG or IPT, such as those issues which involve contractual issues requiring contract changes and agreement between different acquisition activities.

3.8.2 Interface Management Activity Guides

The following guides, **Tables 3-14, 3-15 and Figure 3-6** provide information concerning the appropriate selection of interface documentation and methods of managing the interface. Acquisition program managers can use the guides as an aid in establishing appropriate relationships with other acquisition activities responsible for interfacing systems or items, and for assessing the adequacy of contractor's interface management approaches.

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Activity Guide: Table 3-14. Documentation Defining Interfaces

Document	Definition/ Guidance
a. System Performance Specification	• Defines system level performance and functional interfaces between systems, which act as a design constraint and configuration control mechanism. May reference an interface control drawing for interface specifics, in which case the ICD requirements are part of the System Specification
b. Item Performance Specification	• Defines performance and functional requirements for a CI. Specifications for each interfacing CI reflect the agreed-to interface parameters. This may be accomplished by reference to an ICD.
c. Item Detail Specification	• Defines performance, functional and physical requirements and design details for each CI. Specifications for each interfacing item reflect the agreed-to interface parameters. This may be accomplished by reference to an ICD.
d. Assembly Drawing	• Defines the physical interface between mating parts and subassemblies which comprise an assembly **[Further Detail: ASME Y14.24M]**
e. Installation Drawing	• Provides information for properly positioning and installing items relative to supporting structure and adjacent items, as applicable. May include dimensional data, hardware descriptions, and general configuration information for the installation site. **[Further Detail: ASME Y14.24M]**
f. Interface Control Document or Drawing (ICD)	• Depicts physical, functional and performance interface characteristics of related or co-functioning items (CIs or components). An ICD is prepared to: – Establish and maintain compatibility between items having a common boundary – Coordinate and control interfaces between co-functioning systems through change control – Record and communicate design decisions to participating design activities • An ICD may control one or more of the following types of interface design requirements: – Mechanical, Electrical, Electronic, Hydraulic, Pneumatic, Optical – Operational sequence, system switching – Inter-operability (with allied systems) – Installation - Envelope, Mounting, and Interconnection – Other characteristics which cannot be changed without affecting system interfaces
g. Interface Requirements Specification	**[See Table 3-9, *Activity Guide*: Software Documentation]**
h. Interface Design Document	**[See Table 3-9, *Activity Guide*: Software Documentation]**
i. Control Drawing (Specification, Source), Vendor Item Description, Commercial Item Description, Purchase Description, etc.	**[See Table 3-3, *Activity Guide*: Order of precedence for Specifications, MIL-STD-100, ASME Y14.100]**

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Activity Guide: Table 3-15. Interface Management Process Matrix

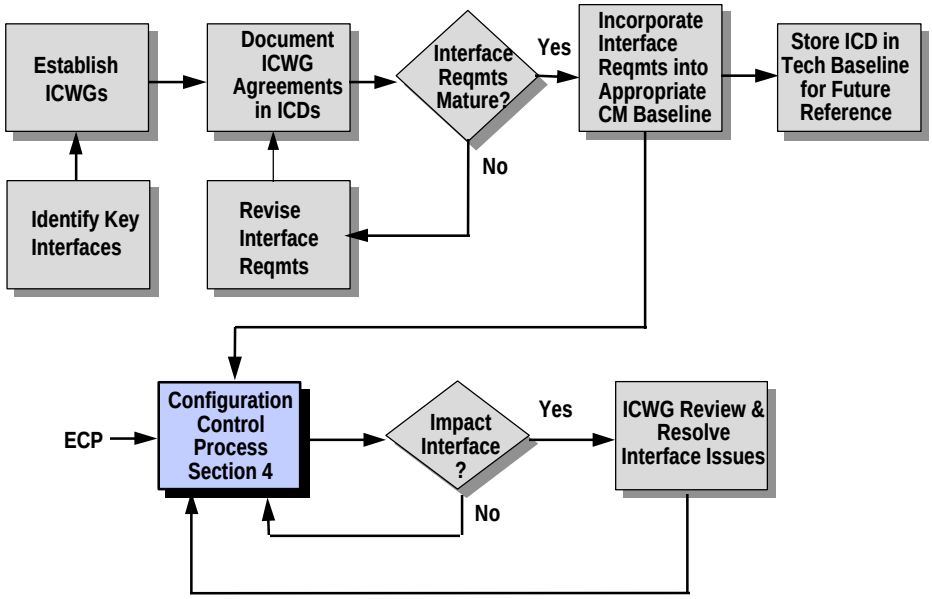
● Interface Illustrated in Figure 3-5			
Types of Interface (Figure 3-15)	**Developmental Status**	**Documents Defining Interface (Reference Table 3-14)**	**Process**
❶ System A to System B: Same Contract, Same Acquiring Activity			
System/System • Performance • Physical • Functional	Case 1: A-Development B-Development Case 2: A-Development B-NDI or COTS[9] (in Production)	• ICD or IDD **(f. or h.)** • System A-System Spec **(a.)** • System B-System Spec **(a.)** • System A-System Spec **(a.)** • System B - Existing documentation **(a. to l., as applicable)**	• ICD/IDD may be used by contractor to document interfaces • Interface requirements included in System Spec(s) • Acquiring Activity approves System Specs establishing functional baseline for each system • Interface is maintained through change control to System and subordinate specifications • In Case 2, the System B interface is accommodated by System A.
❷ System A to System C: Different Contracts; Same Acquiring Activity			
System/System • Performance • Physical • Functional	Case 1 A-Development. C-Development Case 2 A-Development. C-NDI or COTS (Production)	• ICD • System A-System Spec **(a.)** • System B- Spec **(a.)** • System A-System Spec **(a.)** • System C - Existing documentation **(a. to l., as applicable)**	**[See *Activity Guide*: Figure 3-6 for Process Flow]** • Associate Contractor Agreement (ACA) between Contractors A and C establishes Interface Working Group (ICWG) IPT • ICWG IPT develops ICD; approved by both parties • Interface requirements included in System Spec(s) • Acquiring Activity approves System Specs establishing functional baseline for each system • Interface is maintained through change control to System and subordinate specifications • System A interface accommodates known design of System C and is approved and baselined as above • System A contractor negotiates with System C contractor to receive (as a minimum) advance notification of change to system C • Interface is maintained through change control to System A configuration documentation.
❸ System A to System D: Different Contracts; Different Acquiring Activity			
System/System • Performance • Physical • Functional	Case 1 A-Development B-Development	• ICD • System A-System Spec **(a.)** • System B- Spec **(a.)**	**[See *Activity Guide*: Figure 3-6 for Process Flow]** • Memo of Agreement (MOA) between Acquiring Activities, establishing Government Interface Management IPT, if deemed necessary • ACA between Contractors establishing ICWG IPT • ICWG IPT develops ICD; approved by both parties with contractual and performance issues adjudicated by Government Acquiring Activities via Interface Management IPT, as necessary • Interface requirements included in System Specs Acquiring Activities approve respective System Specs establishing functional baseline for each system • Interface is maintained through change control to

[9] NDI - Non Developmental Item; COTS-Commercial Off-The-Shelf. Integrating NDI and/or COTS products into a system presents special configuration management issues and concerns **[See Appendix C.]**

Activity Guide: Table 3-15. Interface Management Process Matrix

● Interface Illustrated in Figure 3-5			
Types of Interface (Figure 3-15)	**Developmental Status**	**Documents Defining Interface (Reference Table 3-14)**	**Process**
			System and subordinate specifications. If there is impact to defined interface, coordination of companion ECPs takes place between contractors and via ICWG IPT and Interface Management IPT, as required
❹ ❺ System A to CI c or CI b, Part 4: Subcontract or Purchase Order			
System/CI or Part from Supplier • Performance • Physical • Functional	Case 1 A-Development CI-Development Case 2 A-Development CI-Production, NDI or COTS	• Item Performance or Detail Spec **(b. or c.)** • Item Performance or Detail Spec, Specification Control Drawing, Vendor Item Description, etc. **(b., c., l. as applicable)**	• System A Contractor allocates requirements from System Spec to Item Spec • Item spec referenced as requirement of subcontract • Same as above • Item documentation cited in subcontract controls the interface
❻ CI a to CIs b and c: Under One Contract			
CI to CI • Performance • Physical • Functional		• System Spec A **(a.)** • Item Performance or Detail Specs for each CI **(b. or c.)** • Installation Drawing **(e.)** or Interface Design Document **(h.)** if CSCI	• Contractor allocates requirements from System Spec to Item Spec • Installation Drawing or IDD governs design details at interface between the CIs
❼ Assembly/Part interfaces within CIs a and b: Under One Contract			
Part to part within CI		• Assembly Drawing **(d.)**	• Contractor controls detailed design via applicable drawings

Activity Guide: Figure 3-6. Interface Management Process Flow



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